THE ROLE OF HELLFIRE ARMED NAVY SEAHAWK HELICOPTERS IN OVERLAND STRIKE OPERATIONS

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General Studies

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This study investigates the potential role of Navy Seahawk helicopters, armed with the AGM-114 hellfire missile system, in overland strike operations. Navy H-60 aircraft have only recently been upgraded to include forward-looking infrared (FLIR) sensors, LASER designation capability, and the Hellfire missile system. The focus of the study is to determine if the recent upgrades in capability can be used to expand the helicopters' mission capabilities to include overland strike. The capabilities of the Sh-60B, HH-60H, and SH-60F aircraft are examined and compared to helicopters of other services that are capable of employing the Hellfire missile in overland strike operations. The various Navy Seahawk aircrew-training programs are similarly compared to identify the impact of expanding the mission capabilities to include overland strike. The study identifies the critical issues surrounding future employment of Navy Seahawk helicopters in overland strike. This study promotes doctrine development for the HH-60H aircraft to include offensive overland strike applications with Hellfire. The development is recommended to increase carrier battle groups strike capability.

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

THE ROLE OF HELLFIRE ARMED NAVY SEAHAWK HELICOPTERS IN OVERLAND STRIKE OPERATIONS by LCDR Robert B. LaRue, USN, 108 pages.

This study investigates the potential role of Navy Seahawk helicopters, armed with the AGM-114 Hellfire missile system, in overland strike operations. Navy H-60 aircraft have only recently been upgraded to include forward-looking infrared (FLIR) sensors, LASER designation capability, and the Hellfire missile system. The focus of the study is to determine if the recent upgrades in capability can be used to expand the helicopters' mission capabilities to include overland strike.

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TABLE OF CONTENTS

ABBREVIATIONS

ASE	Aircraft survivability equipment
ASUW	Antisurface unit warfare
ATA	Air-to-air
BDA	Bomb damage assessment
CAG	Carrier air wing commander
CALL	Center for Army Lessons Learned
CARGRU	Carrier group
CAS	Close air support
CCD-TV	Charged coupled-deice television
CINC	Commander in Chief
CSAR	Combat search and rescue
CVBG	Carrier battle group
CVW	Carrier Air Wing Commanders
DALS	Downed aviator locator system
DESRON	Destroyer squadron commander
DTIC	Defense Technical Information Center
DVO	Direct view optics
EWK	Enhanced weaponization kit
FLIR	Forward-looking infrared
FLOT	Forward line of troops
GPS	Global positioning system
HAL	Helicopter attack light

HAWK	SQR-4A Data link
HCS	Helicopter combat support
HE	High explosive
HEAT	High explosive antitank
HS	Helicopter antisubmarine
HSL	Helicopter antisubmarine light
HUD	Heads-up display
HIRSS	Helicopter infrared suppression system
ILDRTS	Infrared/laser-detecting ranging targeting set
IMC	Instrument meteorological conditions
INS	Inertial navigation system
IRC	Islamic Revolutionary Guard Corps
LAMPS MK III	Light airborne multipurpose Mk III
LOAL-DIR	Lock on after launch
LOAL-HI	Lock on before launch-high
LOAL-LO	Lock on after launch low
LOBL	Lock on before launch
MANPAD	Man-portable air defense missile
MEDEVAC	Medical evacuation
MWS	Missile Warning System
NOE	Nap of the earth
NSW	Naval special warfare
NSWS	Naval special warfare support

NTS	Night targeting system
NVD	Night vision device
POE	Planned operational environment
PGM	Precision-guided munitions
ROC	Required operational capabilities
RWR	Radar warning receiver
SAM	Surface-to-air missile
SAR	Search and rescue
SATCOM	Satelite communications
SMU	Stores management unit
SUCAP	Surface combat air patrol
TACAIR	Tactical aircraft
TAD/PNVS	Target Acquisition and designation system/pilot nightvision sensor
TACD&E	Tactics development and evaluation
TOW	Tube-launched optically wire-guided missile
TVT	Television tracter
USMC	U.S. Marine Corps
USW	Under sea warfare
VERTREP	Vertical replenishment
VMC	Visual meteorologoical conditions

ILLUSTRATIONS

TABLES

CHAPTER 1

BACKGROUND AND INTRODUCTION

Background

As the U.S. Navy shifts from a doctrine based on bipolar war on the high seas to the current doctrine of *Forward . . . From the Sea*, the need to expand the Carrier Battle Groups overland strike capability in littoral regions has become increasingly important. Recent improvements in the capabilities of the Navy's SH-60B and HH-60H Seahawk helicopters present potential improvements in the Carrier Battle Groups strike potential.

The Navy has recently procured the AGM-114 Hellfire missile system for employment by the SH-60B and HH-60H aircraft as part of the Navy's armed helicopter program. This system was purchased to increase the Seahawk's ability to conduct anti-surface unit warfare (ASUW). Basically, the Hellfire system is being fielded to give Navy helicopters the ability to target, attack, and destroy small surface combatants, thus reducing the requirements for fixed-wing surface combat air patrol (SUCAP) sorties in support of the Carrier Battle Group. The Navy Hellfire system currently employed on Seahawk helicopters includes forward-looking infrared (FLIR) and autonomous LASER designation capability.

The Navy's H-60 Armed Helicopter program brings similar Hellfire capability to the SH-60B and HH-60H helicopters to that of the AH-64 Apache and AH-1W Cobra attack helicopters. It is important to note, however, that significant differences exist between the platforms' mission survivability equipment, the traditional missions, and the training of pilots and aircrew. When comparing the potential of Navy H-60 aircraft to the capabilities of Army and U.S. Marine Corps (USMC) attack helicopters, it is important to

understand the critical differences between the mission equipment and training programs that exist between the Navy's H-60 Seahawk communities. The HH-60H has been primarily used for combat search and rescue (CSAR) and naval special warfare (NSW) support. These missions require pilots to train in overland nap of the earth (NOE) flight in night low-illumination levels using night vision devices (NVD). The HH-60H aircrews train to operate over enemy or hostile terrain. The HH-60H has an enhanced aircraft survivability package that includes chaff, flare, and active decoy dispensers; infrared jammer; threat-warning receiver; and a decreased infrared signature. The SH-60B has typically performed only overwater missions of antisubmarine warfare, electronic surveillance measures (ESM), over-the-horizon targeting, and overwater search and rescue (SAR). SH-60B aircrews are not trained or equipped for overland NVD flights, NOE, or terrain following flight in night low-illumination conditions. These inherent differences may present significant training and aircraft compatibility issues when discussing the role of the Seahawk in littoral strike operations.

U.S. Navy tactics for employing Seahawk helicopters equipped with the Hellfire missile system do not address use of the weapons system for attacking land-based targets as part of overland strike operations. Current tactics focus the employment of the Hellfire against waterborne targets. Apparently, this use of the Hellfire-equipped H-60 Seahawk fails to make full use of the system's capabilities. Navy Seahawk helicopters armed with Hellfire could be effective in attacking land targets in support of strike operations. Combat-proven tactics have been developed for the AH-64 Apache, OH-58 Kiowa Warrior, and AH-1W Super Copra helicopters for use of the Hellfire missile system for strike operations. The AH-64 Apache, using Hellfire, opened a critical

corridor in Iraq's air defenses for fixed-wing strike aircraft during the initial phases of the Gulf War.[1] Development of similar and effective tactics could make the Hellfire-equipped Seahawk an effective force multiplier for the Carrier Battle Group during overland littoral strike operations.

The recent improvement in the capability of Seahawk helicopters as a result of the addition of the Hellfire missile system suggests that an expansion of the aircraft's Required Operational Capabilities (ROC) and Planned Operational Environment (POE) is possible. Do Navy Seahawk helicopters employing the Hellfire missile system have a role in overland strike operations? Based on the limited number of Hellfire-equipped Seahawks in the CVBG, the role of the system is presumed to be limited to the destruction of high-value targets. In particular, targets, which are, may be more vulnerable to helicopter attack than attack by fixed-wing or cruise missile attack. Targets meeting these criteria might be mobile targets that cannot be targeted by a specific location, thus making global positioning system (GPS) guided standoff weapons ineffective. Other targets may include enemy air defense missile systems or early warning radar systems that are designed to counter higher flying fixed-wing aircraft. These systems may be more vulnerable to attack by helicopters flying an NOE profile than tactical fixed-wing aircraft.

Purpose of the Study

The purpose of the study is to determine what roles Hellfire-equipped Seahawk helicopters have in overland littoral strike operations? The following areas are examined to answer the research question.

1. The possibility of modifying existing Army and Marine Corps tactics for the use of Hellfire-armed attack helicopters for use by Navy Seahawk helicopters.
2. The potential effectiveness of the Hellfire-equipped Seahawk helicopter in overland littoral strike operations.
3. An evaluation of the views of navy leadership concerning the risk-to-benefit analysis of using Hellfire weapon system employed from Navy Seahawk helicopters for overland strike operations.
4. A determination of what, if any, additional training will be required for the Seahawk crews to be effective in overland strike operations. Given the significant differences in the HH-60H and SH-60B training programs, this analysis will be examined separately for each community.
5. A comparison will be made between the aircraft capabilities of the HH-60H and SH-60B helicopters to those of the AH-64 Apache, OH-58 Kiowa Warrior, and AH-1W Cobra. The study will identify differences in mission, navigation, and survivability equipment. A comparative analysis will be made between the aircraft concerning the mission capability for overland littoral strike operations

Assumptions

The role of Navy helicopters in strike operations will be limited to attacking high-value targets, which may be particularly vulnerable to rotary-wing aircraft. Additionally, the study will examine the utility of using Navy Seahawk helicopters in overland strike operations when Army and USMC attack helicopter assets are not available. This study will not attempt to determine if the Hellfire-equipped Seahawk helicopter can perform all the missions of the AH-64 Apache or AH-1W Cobra weapon systems. Rather, it is to

determine whether the Hellfire-equipped Seahawk can effectively perform a limited role in littoral strike operations.

It is assumed that the Navy will continue to be forward deployed and operate in areas which other service branches are not deployed. Under such circumstances, Naval forces may be required to conduct autonomous littoral strike operations. In the near term, the carrier battle group will deploy with two to three HH-60H and four to six SH-60B Hellfire-equipped helicopters.

Definitions

"Littoral overland strike operations" are overland offensive projections of power against the enemy in regions relating to or existing on a shore or coastal region within direct control of and vulnerable to the striking power of naval expeditionary forces.

A "high-value target" is a target whose loss to the enemy will contribute to the success of the friendly action. An example of a high-value target could be a surface-to-air missile (SAM) site that threatened a Carrier Battle Group's strike corridor. Destroying the SAM site would contribute to the success of the strike.

Limitations

Research into this subject is complicated by the fact that the U.S. Navy has not used helicopters for land attack since the Vietnam conflict. The prevailing view of Navy leadership is that Navy helicopters have little or no utility in strike operations. As a result, little research has been conducted to explore the capabilities of Navy helicopters for strike and land attack missions. The limited sources of information regarding the Navy helicopters' ability to be used in the overland battle can be overcome due to the

commonality of the Navy Hellfire missile system to that of the Army and Marine Corps helicopters which employ Hellfire. The Army Apache and USMC AH-1W Cobra weapon systems have extensive research and tactics development and evaluation (TACD&E) for the employment of the Hellfire missile for deep and strike operations. These resources can be applied to the Seahawk employment.

Delimitations

This research will not address potential conflicts in Navy helicopter resource allocation to multiple mission areas, or the potentials to overtask Navy helicopter assets. The research will not address the Seahawk's capabilities in land attack beyond the support role of attacking high-value targets.

Significance of the Study

The Hellfire missile system has proven highly effective with the Apache and Cobra weapon systems. The Navy has only recently upgraded its H-60 Seahawk helicopters to include Hellfire. The research will attempt to establish whether the successful employment of the Hellfire missile by Army and USMC helicopter assets can be used as a precedent for future use of the Hellfire missile by Navy H-60 Seahawks for littoral strike operations. The research will be aimed at expanding the Navy's theoretical base for employment of its helicopter assets, and assessing the effectiveness of Seahawk helicopters employing the Hellfire as a force multiplier in littoral strike operations. The TACD&E for Navy employment of the Hellfire missile is only the beginning; the research could provide significant insight into how Navy use of the missile system should be directed.

[1]Lange, Adam W. "Hellfire: Getting the most from a lethal missile system," *Armor,* February 1998, 25-30.

CHAPTER 2

SEAHAWK MISSIONS AND EQUIPMENT

The Navy Seahawk helicopter has been adapted to perform a wide variety of roles and missions. The Navy currently operates three series of the H-60 aircraft: the SH-60B (figure 1), SH-60F (figure 2), and the HH-60H (figure 3). Each series has unique capabilities and performs diverse missions. This chapter will briefly describe Navy Seahawk unit organizations and the missions and equipment of each aircraft, to provide the background necessary to begin the examination of the Seahawk's role in littoral strike warfare. The description of the Seahawks' mission equipment and weapons will be focused on factors that apply to the potential littoral strike mission.

Figure 1. SH-60B Seahawk. *Source:* Naval Helicopter Association [web site]; available from www.inetworld.net/rotorrev/400.jpg; Internet; accessed 19 May 1999.

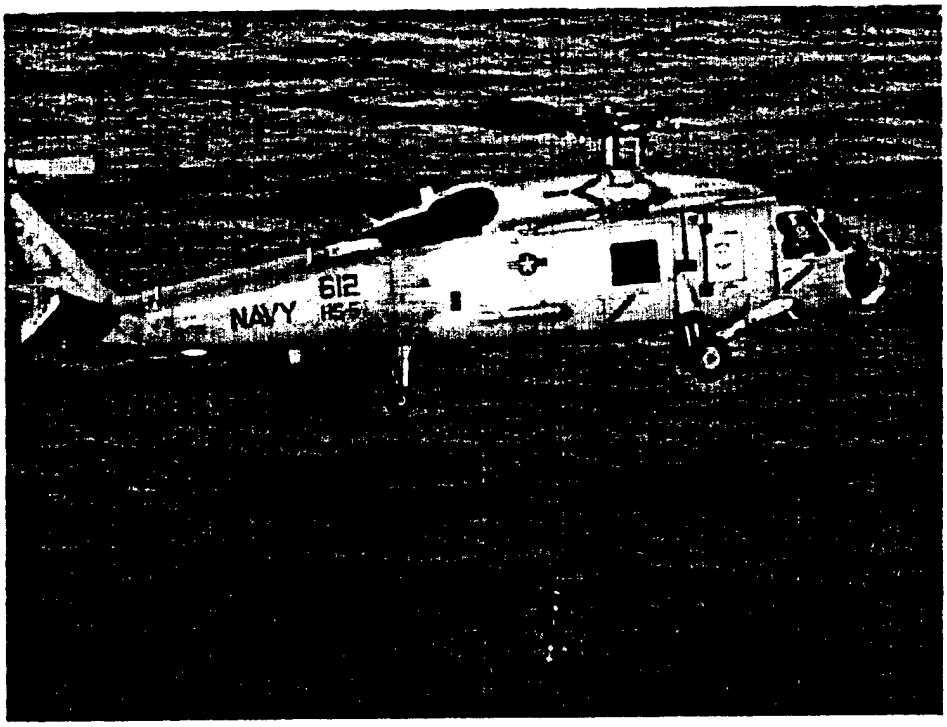

Figure 2. SH-60F Seahawk. *Source:* PH2 Jim Vidrine, U.S. Navy (Photo 960619-N-7340V-00277, 17 June 1996) [U.S. Navy Web Site]; available from www.navy.mil; Internet.

Figure 3. HH-60H Seahawk. *Source:* Helicopter Antisubmarine Wing Atlantic (HH-60-H FLIR/HELLFIRE Operator Training Syllabus) [CD ROM].

The Seahawk Airframe

The Seahawk evolved from the Sikorsky-built U.S. Army UH-60 Blackhawk. The marinized version of the UH-60 is powered by twin 1,700 shaft HP T700-GE-401C turboshaft engines and operates at a maximum gross weight of 21,885 pounds. The Seahawk will cruise at 150 knots with a maximum airspeed of 180 knots and has four hours' endurance without external fuel tanks. The aircraft can carry two external auxiliary fuel tanks, which increase endurance to five-plus hours. The helicopter incorporates automatic blade fold and tail pylon folding capability for shipboard compatibility. The Seahawk's tail wheel is also positioned forward of the UH-60 tail wheel to facilitate small-deck landings.[1]

Seahawk Systems

The Seahawk is a multimission helicopter and has a wide variety of mission equipment and weapons systems. (It is not considered in this thesis that the Seahawk's antisubmarine systems and weapons provide capability for overland strike operations, so this information is omitted from the discussion.)

The Seahawk navigation system is comprised of a Doppler radar set TACAN transceiver, a tactical navigation and mission computer, and a global positioning system (GPS) receiver. The Seahawk navigation system is extremely accurate which is of vast importance for overland strike operations. The navigation system will allow the aircraft to find and subsequently destroy point targets. The pilot's navigational display is updated by inputs from the Doppler radar, which provides aircraft drift relative to the surface, or from continuous inputs from the GPS receiver. The system is capable of displaying and navigating to programmed waypoints and tactical symbology. The SH-60F and HH-60H

navigation systems can be programmed using a mission data loader. The mission data loader greatly reduces aircrew in-flight workload by allowing the information to be compiled and inputted during preflight mission planning.

The typical communications suite includes two very/ultrahigh frequency (V/UHF) radios with direction-finding capability, a high frequency (HF) radio, and an identification friend or foe (IFF) transponder. The IFF transponder system allows surface and air forces to electronically identify friendly aircraft. The KY-58 V/UHF Secure, and KY-75 HF Secure provide encrypted secure communications. The HH-60H is equipped with LST-5 SATCOM. This system provides long-range communications not limited by line of sight, thus enabling communications even while the helicopter is masked by terrain. The HH-60H also includes the Downed Aviator Locator System (DALS) which provides bearing and range information to downed aviators or any persons carrying the PRC-112 survival radio. It would be possible to use the DALS system in littoral strike operations by equipping special operations or ground forces with the PRC-112 radio thus providing the helicopter covert terminal guidance to targets identified by the ground forces. The SH-60B has excellent data link capability using the SQR 4A (HAWK) link. The link provides tactical and sensor information to be securely transmitted to other HAWK link-capable platforms.[2] The SH-60F and HH-60H link capabilities are limited to transmitting secure tactical data between other SH-60F/HH-60H aircraft.

Night Vision Systems

The AN/AAS-44 (V) infrared/laser detecting ranging targeting set (ILDRTS) provides detection and identification of targets at night and during periods of low visibility. The ILDRTS is a stabilized, three field-of-view infrared imagery system. The

imagery is displayed in the cockpit and cabin tactical stations. The imagery can be linked real-time to surface combatants using the Hawk link. The aircrew is equipped with AN/AVS-6 night-vision devices (NVD). These NVDs allow aircrews to perform night low-level terrain following flight and improve safety and mission capability during overwater missions. The HH-60H has fully NVD compatible interior and exterior lighting. The SH-60B does not have NVD compatible lighting. However, slightly degraded NVD capability can be achieved by installing NVD lighting kits. The HH-60H has a NVD heads-up display (HUD) system, which provides altitude, navigation, weapons, and warning cues to the pilots AN/AVS NVDs. The NVD HUD improves pilot efficiency by allowing the pilot to scan outside the aircraft while receiving necessary mission and flight information.

Aircraft Sensors

The AN/APS 124 radar allows the aircraft to detect and track surface contacts. The system incorporates an IFF interrogation capability. The AN/ALQ-142 electronic surveillance system allows the aircraft to passively detect electromagnetic emissions. The system identifies, classifies, and provides bearing information for received signals.

Aircraft Survivability Equipment

The HH-60H was designed to operate in a hostile environment. The aircraft has a well-integrated and effective survivability equipment package. The SH-60B ASE system incorporates some but not all of the HH-60H systems (see table 1). The HH-60H's infrared signature is reduced by helicopter infrared suppression system (HIRSS) exhaust

baffling. Pilot seats are armored to provide protection from small arms fire. Wire cutters provide wire-strike protection.

Table 1. Seahawk Equipment

			SH-60F	HH-60H	SH-60B
Navigation	Doppler Radar		X	X	X
	GPS		X	X	Note 1
	Mission Data Loader		X	X	
	V/UHF Radio		X	X	X
Comm					
	HF Radio	Allows terrain masking	X	X	X
	SATCOM			X	
	DALS			X	
	HAWK Link				X
	Tactical data link		X	X	
	IFF		X	X	X
	KY-58 V/UHF Secure Voice		X	X	X
	KY-75 HF Secure Voice		X	X	X
	AN/AAS-44 ILDRTS		Note 3	X	X
	NVD HUD			X	
	NVD lighting			X	
	AN/APS 124 RADAR				X
	AN/ALQ 142 ESM				X
	Wire strike protection			X	
	HIRSS IR reduction			X	
	AN/APR39 Radar warning			X	
	AN/AAR-47 Missile warning			X	Note 2
	AN/ALE-39 Countermeasures			X	Note 2
	AN/ALE-47 Countermeasures			X	
	AN/ALQ-44 IR JAMMING			X	Note 2
	HELLFIRE	8 km range, laser guided	Note 3	X	Note 2
	PENGUIN				Note 1
	GAU-16 .50 Cal			X	X
	GAU-17 Mini gun			X	
	M60D Machine Gun		X	X	X
	M24O Machine Gun			X	

Note 1: Block 1 upgrade aircraft only
Note 2: Block 1 upgrade and EWK upgrade only
Note 3: SH-60F programmed for EWK upgrade in FY02

The AN/APR-39 (V) radar-warning receiver (RWR) is a passive, omnidirectional system that receives and displays to the pilot information regarding the radar environment. The RWR attempts to correlate high-band (tracking) and low-band (missile guidance) signals that would indicate an active surface-to-air missile (SAM) site.

Uncorrelated signals are displayed as spokes on the cockpit display indicator. Correlated signals will be displayed and warning tones will warn the pilot of an imminent SAM launch.

The AN/AAR-47 Missile Warning System (MWS) is a passive, electro-optical system, that provides indications of incoming missiles to the pilots. The system detects the infrared signature of a missile's rocket motor plume and classifies the signal as a threat or no-threat by measuring signal intensity over time. If the signal is determined to be a threat, a visual warning will be displayed on the cockpit control indicator and on the NVG HUD and an audio warning will transmitted to the pilot's headset.

The AN/ALE-39 countermeasures dispensing system enables either manual or automatic dispensing of chaff and or flares to counter various tracking radar or infrared homing missiles. The systems automatic mode receives a signal from the MWS and dispenses chaff and flares in amounts that were preprogrammed in the system. The AN/ALE-47 is an updated countermeasure dispensing system that incorporates a semi-automatic mode that requires the pilot initiate the dispensing of preprogrammed countermeasures.

The aircraft also incorporates an AN/ALQ-144 infrared countermeasures set that provides the Seahawk an infrared, missile-jamming capability. The system is an active countermeasure that generates infrared energy. The system modulates and projects infrared energy away from the aircraft to confuse infrared, energy-seeking missiles.[3]

Weapons Systems

The Seahawk was recently upgraded to include the Enhanced Weaponization Kit (EWK) which provides the aircraft the ability to detect, laser designate, and attack targets with the Hellfire AGM-114 missile. The EWK includes the AN/AAS-44 nose-mounted Infrared/Laser Detecting Ranging Targeting Set (ILDRTS), the Stores Management Unit (SMU), M299 Hellfire Launcher, and the Hellfire missile (figure 4). The Navy is

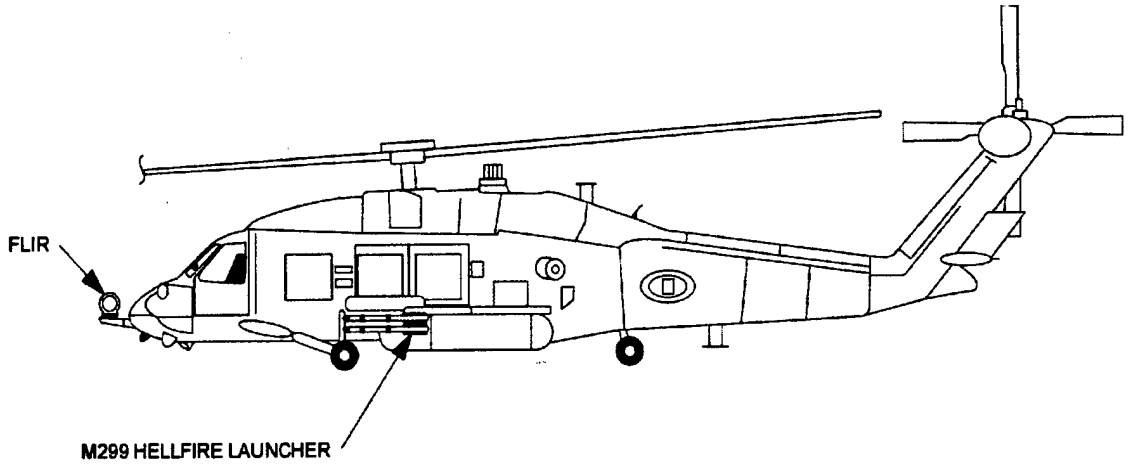

Figure 4. HH-60H Hellfire/FLIR Upgrade. *Source:* Helicopter Antisubmarine Wing Atlantic (HH-60-HFLIR/HELLFIRE Operator Training Syllabus) [CD ROM].

currently fitting the EWK on SH-60B and HH-60H aircraft. The system allows the aircraft to carry and employ four AGM-114 Hellfire missiles. The Hellfire missile is a multimission, antiarmor, and precision attack weapon that is effective against tanks, bunkers, structures, and small ships. The missile is a semiactive laser-guided missile with a range of eight kilometers. The missile is manufactured with eight-kilogram high-

explosive (HE) blast and or fragmentation and with tandem high-explosive antitank (HEAT) warheads.

The SH-60B can carry one AGM-119 Penguin missile in lieu of the Hellfire system. The Penguin is capable against small surface combatants and surfaced submarines. The missile uses an inertial navigation system and has a countermeasure resistant infrared seeker. The Penguin has a 120-kilogram, semiarmor-piercing warhead. The missile weighs 847 pounds and has a maximum range of twenty-five nautical miles.[4]

The HH-60H carries two crew-served machine guns. The aircraft is capable of employing the GAU-17 minigun, M240 7.62-millimeter machine guns, or the M60D 7.62-millimeter machine guns. The M240D machine gun is capable of maintaining a sustained rate of fire of 100 rounds per minute, a rapid-fire cyclic rate of 650-950 rounds per minute. The GAU-17 is an externally powered, six-barrel, air-cooled, multipurpose weapon capable of firing at a rate of 2,000 or 4,000 rounds per minute. The SH-60B/F models carry one crew-served M-60D machine gun or one GAU-16 (.50 caliber) machine gun in the starboard cabin door. The M60D is capable of sustained and cyclic rates of fire of 200 and 550 rounds per minute, with a maximum effective range of 900 meters.

Seahawk Organizations and Missions

The Navy organizations that operate the Seahawks are as different as the series of Navy H-60s. The organizations can be categorized into three communities, the Light Airborne Multipurpose Mk III (LAMPS MK III) community, the Helicopter Antisubmarine (HS) community, and the Helicopter Combat Support (HCS) community. Each community has unique organizations and command relationships and performs a

different set of missions. The communities train differently and separately with unique operational priorities.

The LAMPS MK III community was established in 1984 to extend the combat effectiveness of Navy surface combatants. The LAMPS MK III weapon system is comprised of the SH-60B and the LAMPS-capable surface ships. The system is a fully integrated ship and or air weapons system designed to enhance the ship's ability to detect, localize, track, and attack surface and subsurface targets. The SH-60B is operated by Helicopter Antisubmarine Light (HSL) squadrons. The HSL squadrons are shore-based organizations which train, maintain, and organize detachments to deploy with the surface combatants. The detachments are task organized to meet the needs of the surface ship they will deploy with. A typical detachment will have two SH-60B aircraft, six pilots, five enlisted aircrew members, and sixteen aircraft maintainers. The detachments maintain and operate the aircraft self-sufficiently.

The HSL detachment will be married to a specific surface ship for the duration of the training and deployment cycles. This enhances the coordination between the detachment and the ship. The detachment is under the operational control of the destroyer squadron commander (DESRON) through the ship's commanding officer while deployed and maintains administrative ties with the parent squadron. As such, the HSL aircraft are not under the operational control of the carrier air wing commander (CAG) who is also the strike warfare commander.

Currently, the LAMPS MK III primary missions are under sea warfare (USW) and antisurface unit warfare (ASUW). With secondary missions of vertical replenishment (VERTREP), search and rescue (SAR), medical evacuation (MEDEVAC),

naval gun fire support (NGFS) spotting and controlling naval gunfire from the parent ship, and communications relay (COMREL).[5]

The Helicopter antisubmarine (HS) community was established in1952 to provide inner zone antisubmarine coverage for the aircraft carriers. In 1989, the HS squadrons transitioned from the SH-3 to the SH-60F. In 1991, the HS community added the HH-60H to its inventory. Currently the HS squadrons operate a mix of four SH-60F and three HH-60H aircraft. These squadrons have a typical complement of 28 officers (25 pilots), 25 enlisted aircrew members, and 150 maintenance and administrative personnel.

The HS squadron is deployed with the entire squadron embarked on an aircraft carrier. The squadron is assigned to a carrier air wing (CVW) and receives operational tasking from the CAG. The CVW deploys with a particular aircraft carrier for the duration of the training and deployment cycles. The CVW training cycle includes extensive strike warfare training at naval air station (NAS) Fallon. As part of the CVW, the HS squadron currently is evolved in the planning and execution of strike missions. However, the squadron's current role is that of combat search and rescue (CSAR) support, not to be a strike asset.

The HS squadron's primary missions are under sea warfare, combat search and rescue (CSAR), and special warfare support (NSWS). The HH-60H is currently the only Navy helicopter certified to operate in an overland hostile environment. Secondary missions include antisurface unit warfare (ASUW), search and rescue (SAR), vertical replenishment (VERTREP), fleet logistic support, mine countermeasures, and medical evacuation (MEDEVAC).

The Helicopter Combat Support (HCS) community was created in 1988 as part of the Naval Reserve Force to replace the reserve force Helicopter Attack Light (HAL) and HC-9, the reserve force combat search and rescue squadrons. The reserve currently operates two HCS squadrons. These squadrons operate 60 percent of the Navy's HH-60H aircraft.[6] The squadrons are under the operational and administrative command of Helicopter Wing Reserve. HCS squadrons can create and deploy four detachments of two HH-60Hs. Each squadron maintains one detachment in alert status prepared to deploy anywhere in the world on seventy-two hours notice. The HCS detachments can and have been assigned the HS squadrons to augment battle groups' NSW and CSAR forces. HCS detachments can operate autonomously from shore bases to support a theater of operations.[7]

The HCS community's primary missions are combat search and rescue (CSAR), special warfare support. Secondary missions are antisurface unit warfare and logistics support.[8]

The Seahawk is a capable multimission helicopter. Each series of the aircraft has unique capabilities and limitations. The organizations which employ the aircraft are equally unique. While answering the question, What role do Navy Seahawk helicopters, armed with the Hellfire missile system, play in overland strike operations? it is important to remember that the Navy Seahawk communities are not homogeneous and the potential roles of the Seahawk communities may be quite different.

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[1]Paul Jackson, ed., "Sikorsky S-70B," *Jane's All the World's Aircraft 1998-99,* Jane's Yearbooks (Alexandria, VA: Jane's Information Group, 1998), 736-737.

[2]U.S. Navy, Naval Warfare Publication 3-22.5, *SH-60B Tactical Manual* [CD-ROM] (Navy Tactical Support Activity, Washington, DC, December 1997) , available from NTIC release series B1.

[3]MAJ Randy C. Nelson, "The Combat Use of Apache Helicopters in Kuwaiti Theater of Operations--Effective or Not?" (MMAS Thesis, U.S. Army Command and General Staff College, Ft. Leavenworth, KS, June 1992), 21.

[4]LCDR Matt Dolan, USN, *Penguin Hits the Fleet*, available from http://www.inetworld.net/rotorrev/penguin.htm; internet.

[5]"SH-60B," [Naval Helicopter Association web site] available from http:/www.inetworld.net/rotorrev/sh60b.htm.

[6]U.S. Navy, *Vision Presence Power,* 1998 ed. (Washington, DC: Department of the Navy, May 1998), 20.

[7]"HCS history," available from http://www.quokka.com/ema/hcs-5/history.htm; internet.

[8]U.S. Navy, Naval Warfare Publication 3-22.5, 1.5.

CHAPTER 3

LITERATURE REVIEW

The review of literature is designed to illuminate answers to the research question of what role, if any, Navy Seahawk helicopters armed with the Hellfire missile system can play in littoral strike operations. No literature could be found that directly addresses the role of the Seahawk in overland strike operations. However, sufficient literature exists on the AH-64 Apache, OH-58D Kiowa Warrior, and AH-1 Cobra helicopters combat use of the Hellfire system. This information is useful in determining the missile systems performance in strike roles. There is also literature on the use of USMC and Army helicopters deployed on Navy ships. This information provides the historical background that establishes the need for armed helicopters on naval vessels. The discussion of the armed Navy H-60s is limited in scope to the aircraft's role in antisurface unit warfare. The lack of information on planned or theoretical use of Navy H-60 helicopters armed with Hellfire in strike warfare is possibly due to the relative newness of the Hellfire system from a Navy perspective and to the traditional viewpoint that fixed-wing aircraft hold a monopoly for placing ordnance on target.

The AH-64 Apache (Army)

The AH-64 Apache (figure 5) was developed for the U.S. Army by McDonnell Douglas aircraft corporation. "The Apache was, as much as anything, a concept driven by clear thinking about the prospect of overwhelming numbers of Soviet tanks maneuvering unrestrained across Europe. The search was on for a solution to a terrifying

problem which, left unaddressed, could result in escalation. With sixteen Hellfires aboard a single Apache, it was theorized a lot of damage could be done."[1]

Figure 5. AH-64 Apache. *Source:* Richard G. Marshall, US Army TACOM-ACALA, AH-64A Apache Photo Gallery, page 1 [ACALA Home Page] available from http://www-acala1.ria.army.mil/ACALA/sma/asa/ah-641.htm; Internet.

The Apache was fielded in 1984 and is arguably still the world's most advanced and capable attack helicopter. The Apache is a two-seated helicopter, powered by two General Electric T700-701 turboshaft engines. The engines produce 1,857-shaft horsepower, and the aircraft cruises at 150 knots. The aircraft maximum range is 350 nautical miles, 800 nautical miles with nontactical external fuel tanks.

The Apache has a robust weapons system that includes four armament hard points and a 30-millimeter cannon. Each hard point is capable of carrying either four AGM-114 Hellfire missiles, a 70-millimeter rocket pod (nineteen rockets each), or a 230-gallon external fuel auxiliary tank.[2] The Apache's belly-mounted, McDonnell-Douglas, M230,

automatic 30-millimeter is capable of firing 600 rounds per minute. The aircraft is capable of carrying 1,200 rounds of 30-millimeter ammunition in its magazine.[3] Cannon targeting is accomplished by the aircraft's helmet-mounted sight, which slews the cannon, based on the crewmember's line of sight.[4] The Apache's fire-control computer refines the targeting of the cannon based on ballistic data. The M230A1, 30-millimeter cannon, has a maximum range of 4,000 meters with a maximum effective range of 1,500 to 1,700 meters.[5] The M230A1 is capable of destroying former Soviet BMP fighting vehicles and other lightly armored targets.[6] The Apache is capable of carrying up to seventy-six, 70-millimeter rockets. The rockets can be fired in all flight profiles. The 70-millimeter rockets with MK 66 motors have a maximum range of 9,000 meters and are effective 3,000 to 4,000 meters. The rockets can be fused for point detonation, air burst, and penetration delay. Warhead types are high-explosive shaped charge, antiarmor, Flachette antipersonnel, white phosphorus smoke, and illumination.[7] "The Apache's point target weapons system, commonly called Hellfire, is the primary armament system on the helicopter. Hellfire provides the Apache a capability to destroy tanks and hard-material targets at standoff ranges. The system provides the capability to fire laser guided missiles on or off the ground at speeds from hover to maximum level flight speeds."[8] A description of the Hellfire missile capabilities is included later in this chapter.

"The Apache's Target Acquisition and Designation System/Pilot night vision Sensor (TAD/PNVS) provides the Apache its day, night, and limited adverse-weather targeting information and night-navigation capabilities."[9] The TAD/PNVS system is mounted in a turret on the nose of the helicopter. The TADS provides 126x-

magnification day television, a 36x-magnification FLIR sighting system, and an 18x-magnification direct view optical system. The TADS day television operates in the near-infrared region of the "day-light" spectrum. This near infrared provides for enhanced performance in smoke, haze, and other obscuring conditions.[10] The Apache night vision system incorporates a nose-mounted FLIR sensor that provides thermal imagery with superimposed symbols to the pilots using helmet mounted and instrument panel mounted displays. Under certain ambient environmental conditions, the performance of the Apache's FLIR is degraded. To improve the pilots' night vision under degraded conditions, Apache crews fly with the AN/AVS-6 night vision goggles.[11]

The Apache aircraft survivability equipment (ASE) includes infrared and radar jammers, radar-warning system, and countermeasures dispensing system. The APR-39 radar-warning system provides radar warning. "The AN/ALQ-136 radar countermeasures set provides the Apache with a radar-jamming capability. The radar-countermeasures system receives and identifies pulsed-radar signals. When threatening radar signals are detected, the system automatically selects and transmits appropriate radar-jamming signals."[12] Infrared jamming capability is provided by the AN/ALQ-144 IR countermeasures. A radar and IR countermeasure dispensing is provided by the AN/ALE-39 countermeasure dispensing set.

The Apache communication and navigation systems are similar to those of the Seahawk. The Apache does not have SATCOM capability or integrated GPS navigation. The Apache, however, has Have-Quick, frequency-hopping capability not found in Seahawk helicopters.

AH-64 Apache Employment in Desert Storm

The 1991 war with Iraq not only validated the capability of the Apache, the conflict was the backdrop for newer, more-wide-ranging roles for attack helicopters. The existing U.S. Army doctrine of "AirLand Battle" called for helicopters to assist infantry and armor forces during offensive and defensive operations. The tank was still seen as the primary offensive penetration force. The capability of the Apache, however, exceeded expectations and allowed expansion of its doctrinal role. The Gulf War had an unexpected evolutionary effect on the roles of attack helicopters. Apaches performed a wide variety of roles and missions. In many cases Apache units operated as a separate maneuver force, spearheading offensive operations with armor and infantry struggling to keep up with the pace of the attack helicopter offensive.[13] "The speed and depth of combat operations during Desert Storm should renew interest in achieving a new dimension of land warfare where the centerpiece of the combined arms organization is the attack helicopter."[14]

The Apache not only redefined its role as part of the Army's combined arms team, it performed a wide variety of missions, separate from ground maneuver forces, that did not directly support ground forces. Perhaps the greatest example of nontraditional attack helicopter employment was the Apache's role in Operation Normandy.

> At 0100 hours on 17 January 1991, eight AH-64 Apaches from the 101st Division (Air Assault) depart from a staging airfield in Western Saudi Arabia on a mission code-named "Normandy." The decisive point of the operation is the destruction of two key Iraqi radar sites located about 35 miles apart. Split into two teams of four in order to service both targets at once, both teams conduct a 90-minute, low-altitude, night- vision goggle flight into Western Iraq under strict radio listening silence. At exactly 0238 hours, the Apaches fire a volley of 27 Hellfire missiles, destroying critical targets at each radar site. Four and one-half

> minutes later, with the first shots of Operation Desert Storm successfully delivered, over one hundred Coalition jets begin streaking up a "blind" Iraqi air corridor approximately 20 miles wide enroute to multiple targets in Baghdad. Mission complete the Apaches cautiously wheel around to begin their egress home, and the Gulf War is on.[15]

The Apaches not only silenced the Iraqi radars, they provided real-time battle damage assessment, which allowed the commanders to commit fixed-wing attack forces with assured impunity from Iraqi air defense radar coverage.

The Apache's success in the Gulf War was wide ranging. The Army deployed 277 Apaches to Southwest Asia in support of Operation Desert Storm. The Apache carried out armed reconnaissance, antiarmor, helicopter escort missions, deep strike missions, and attack missions of massed Apaches as integrated maneuver elements.[16] The Apaches performance earned the helicopter a well-deserved reputation. Major General Griffith, CG 1st Armored Division, reflected the attitude of the Army commanders when he said, "I don't want another minute to go by without Apaches out in front of this Division."[17]

AH-1W Super Cobra (Marine Corps)

The AH-1W Super Cobra (figure 6) was developed for the U.S. Marine Corps in the early 1980s to fulfill USMC needs for a modern heavy attack helicopter. First delivered in 1986, the AH-1W is a two-seated helicopter, powered by two General Electric T700-401C turboshaft engines. The engines produce 1,700-shaft horsepower, and the helicopter has a maximum level speed of 150 knots. The helicopter has a maximum range of 350 nautical miles with endurance of three hours.[18]

> The AH-1W is intended to perform the following aircraft tasks: (1) Provide fire support and security for forward and rear area forces, (2) Conduct point target/anti-armor operations, (3) Conduct anti-helicopter operations,

(4) Provide armed escort, control, and coordination for assault support operations, (5) Control, coordinate, and provide terminal guidance for supporting arms to include close air support, artillery, mortars, and naval gunfire, (6) Provide point and limited area air defense from threat fixed-wing aircraft, (7) Conduct armed and visual reconnaissance, (8) Augment local search and rescue assets, (9) Maintain the capability to operate from amphibious shipping, other floating bases, and austere shore bases as required, (10) Maintain the capability to operate at night, in adverse weather, and under instrument flight conditions at extended ranges.[19]

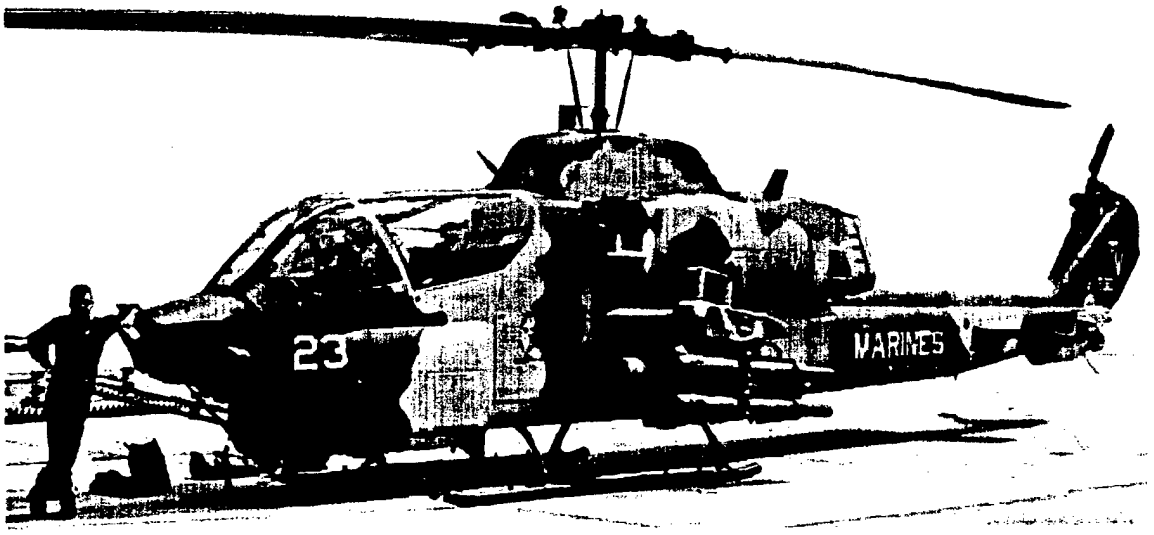

Figure 6. AH-1W Super Cobra. *Source:* Combatsim.Com, Inc., [web site] available from www. Combatsim.com/ah-1w.htm internet, accessed May 1999.

The AH-1W has extensive weapons capability provided by a 20-millimeter cannon and four pylon weapons stations. The weapons stations are capable of carrying four AGM-114 Hellfire missiles (maximum load of eight AGM-114), four BGM-71 TOW missiles (maximum load of eight BGM-71), a GPU-2A gun pod, an AIM-9 Sidewinder missile, an AGM-122A Sidearm, a LAU-10 5-inch rocket launcher, a LAU-61 70-millimeter rocket launcher, or an external fuel tank. The M197 20-millimeter cannon is a three-barreled gun-mounted under the nose of the aircraft. The weapon is

capable of firing between 1,500 and 3,000 rounds per minute and has an effective range of 2,000 meters.[20] The AH-1W carries a maximum load of 750 20-millimeter rounds, and the weapon is effective to 2,000 meters. The GPU-2A 20-millimeter gun pod is capable of carrying 200 rounds of ammunition. The BGM-71 TOW wire-guided missile is a PGM capable of destroying armored targets. The TOW has a minimum range of 500 meters and a maximum range of 3,750 meters.[21] The LAU-10 rocket launchers are capable of carrying four 5-inch rockets. The rockets may be armed with high-explosive/fragmentary, antitank, antipersonnel, smoke, and chaff warheads. The LAU-61 70-millimeter rocket launchers carry nineteen rockets, with identical capability of the AH-64 rocket system described earlier.

The Cobra has a unique capability, with respect to U.S. attack helicopters, with the AIM-9 Sidewinder and AGM-122 Sidearm missiles. The AIM-9 Sidewinder is a passive infrared-homing, all-aspect, air-to-air missile. The missile allows the Cobra to engage air targets from all aspects instead of requiring a stern approach to lock on the target. The Sidewinder has a range of 8 kilometers and attains speeds in excess of Mach 2.[22] The AGM-122A Sidearm is designed to give the Cobra the ability to conduct both offensive and defensive attacks against radar and radar SAM systems that are of a particular threat to assault and attack helicopters.[23] The Sidearm is basically a Sidewinder, with a passive radar-homing guidance. The Sidearm has a range of a range of 8 kilometers.[24]

AH-1W targeting is accomplished using the night-targeting system (NTS). The NTS is an electro-optical system, based on the M-65 telescopic sight unit that is designed to provide AH-1W aircrew with the capability to detect, recognize, identify, track, laser

range, and laser designate tactical targets during day and night adverse weather conditions. The NTS is comprised of the following subsystems: forward-looking infrared (FLIR), charged coupled-device television (CCD-TV), direct-view optics (DVO), AN/ASQ-211 laser designator range-finder system, and television tracker (TVT). The TVT (commonly called the auto-tracker) and videocassette recorder operate in conjunction with the CCD-TV and FLIR only. The TVT allows the Cobra to use the AGM-114 Hellfire missile effectively in an air-to-air role.[25]

The Cobra's aircraft survivability equipment (ASE) package includes an AN/APR-39A (V) 2 radar signal-detecting set, an AN/ALE-39 countermeasures dispensing set, an AN/AVR-2 laser-warning receiver, an AN/APR-44 (V) 3 radar-warning receiver, and an AN/ALQ-144 (V) 1 infrared jammer system. The AN/AVR-2 detects and displays information concerning the laser environment surrounding the aircraft. Information is displayed on cockpit indicators, and the pilot receives an audible warning in his headset. The AN/APR-44 (V) 3 detects and provides warning of SAM and air-to-air missile threats, and provides cockpit indications and audible warnings. Like the HH-60H, the ASE is integrated to provide automatic countermeasures dispensing, if so programmed, with valid threat warnings from the radar warning or plume detecting sensors.[26]

The Cobra communication suite includes two V/UHF radios with KY-58 Secure voice capability and an IFF transponder. Navigation systems include a TACAN transceiver, ADF, and an embedded GPS/inertial navigation system which provides precise navigation.

AH-1W Super Cobra Employment in Desert Storm

The AH-1Ws participating in Desert Storm were not equipped with the NTS. However, the Cobra was effective during night attack operations by using NVGs, illumination flares, and remote laser designation from ground forces and OH-58Ds.[27] The Marine Corps deployed forty-eight AH-1Ws, two-thirds of the active Cobra force, to Southwest Asia during Desert Shield and Storm.[28] Typical Cobra missions included antiarmor, close air support, armed reconnaissance, and helicopter escort.[29]

Marine Cobras, in coordination with OH-58Ds and other coalition aircraft, played a significant rule in repulsing Iraqi incursions into Saudi Arabia before the coalition ground offensive.[30] Like the Apache, Cobras were used in mass as a separate mass maneuver force.

> On G+2, AH-1s and a UH-1 supported Task Force Ripper in the battle with the Iraqi 3rd Armored Division. The UH-1N with FLIR and laser designation capability led two divisions of Cobras through smoke and under power lines to attack Iraqi forces facing the Marines. The Huey then designated targets for the Cobras' Hellfire missiles. On another occasion, Cobras worked with light armored vehicles to thwart an Iraqi mechanized infantry brigade counter-attack against the 1st Marine Division's command post.[31]

Only 48 Cobras were deployed in Desert Storm. Yet these aircraft killed 97 tanks, 104 armored personnel carriers, 16 bunkers, and 2 antiaircraft artillery sites without the loss of a single aircraft.[32]

OH-58D Kiowa Warrior (Army)

The OH-58D Kiowa Warrior (figure 7) was delivered to the U.S. Army in 1991 to replace Army AH-1S Cobra attack helicopters in air cavalry troops and light attack companies.[33] The OH-58D is a two-seat helicopter, powered by a single Allison 250-C30R turboshaft engine. The engine produces 650-shaft horsepower, and the helicopter

has a maximum airspeed of 130 knots and cruises at 114 knots. The aircraft has a maximum range of 223 nautical miles with no weapons and a combat radius of 65 nautical miles.[34]

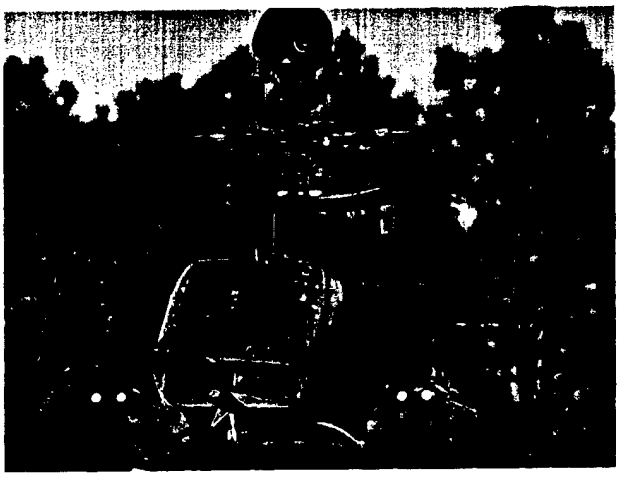

Figure 7. OH-58D Kiowa Warrior. *Source:* U.S. Army War Fighting Center, "CGSC Class 98-99 Aviation Branch Day," Army Aviation Photo Library [CD ROM].

The Kiowa Warrior has two armament hard points. Each hard point is capable of carrying either two AGM-114 Hellfire missiles, a M260 70-millimeter rocket pod (seven rockets each), two air-to-air Stinger missiles, or a XM296 .50 caliber machine gun. The capabilities of the OH-58 70-millimeter rocket system are nearly identical to that of the Apache with the exception that the pods carry 7 versus 19 rockets. The OH-58D has the capability to target and engage targets with Hellfire with a maximum of four missiles. The XM296 is a pod-mounted, electrical-solenoid-actuated, automatic, recoil-operated, link-belt fed, air-cooled, machine gun.[35] The weapon holds 500 rounds, with a maximum range of 2,000 meters with an effective range of 1,000 meters.[36] The OH-58D has an

air-to-air (ATA) engagement capability with the Stinger missile. The missile is an aeronautically adapted version of the Stinger man-portable air defense missile (MANPAD). The missile uses heat-seeking acquisition and guidance and has a maximum range of 4,000 meters.

The OH-58D targeting sensors are located in a mast-mounted sight system. The sight includes a high-resolution TV camera for long-range, low-light target detection and designation, an infrared thermal-imaging sensor for navigation, target acquisition and designation at night or under obscured conditions, and a laser range finder/designator. The mast-mounted site gives the OH-58D the capability to acquire and designate targets while the helicopter remains masked by terrain with only the mast exposed.[37]

The Kiowa Warrior aircraft survivability equipment (ASE) is somewhat limited compared to most modern U.S. attack helicopters. The aircraft has a radar-warning capability with its APR-39 (V) or APR-44 (V) 3 radar-warning receiver. Some aircraft are equipped with an AN/ALQ-144 infrared jammer to defeat infrared-seeking missiles, and AN/AVR-2 laser-detection capability. The Kiowa Warrior airframes are fitted with wire cutters to provide wire-strike protection. The lack of extensive ASE is offset somewhat by the increased survivability provided by the aircraft's low-visual, radar, and IR signature, and the helicopters ability to prosecute targets while remaining masked by terrain provided by the mast-mounted site.

The OH-58D has superior communications capability with five transceivers, Have Quick II frequency-hopping capability and a digital data link. However, the OH-58D lacks Instrument Flight Rules (IFR) navigation equipment and is not certified for instrument meteorological conditions (IMC) flight.[38] This lack of IMC flight capability

the employment of the helicopter to flying only day/night visual meteorological conditions (VMC). Recently built or reworked Kiowa Warriors have an embedded GPS/Inertial Navigation System (INS) which provides a precise navigation capability. It should be noted, however, that GPS is not certified for IMC navigation.

Kiowa Warrior Employment in Desert Storm

Like the Apache, the OH-58D enjoyed considerable success in operation Desert Storm. One hundred and thirty Kiowa Warrior helicopters were deployed to Southwest Asia in support of the operation.[39] The OH-58D helicopters performed a wide variety of missions including artillery support, scouts for reconnaissance and screening missions, designation for AH-64 Apache and AH-1W Cobra helicopters firing Hellfire missiles, and designation for coalition fixed-wing aircraft dropping laser-guided bombs. "In the artillery support role the OH-58D provided lasing for COPPERHEAD laser-guided 155-millimeter artillery munitions. In one example OH-58Ds designated for 12 Copperhead rounds with 12 confirmed hits."[40] In addition to the OH-58D battlefield success, the aircraft also provided valuable intelligence and battle damage assessment imagery with the use of its onboard video recorder.[41]

> Of particular interest to this paper, the OH-58D enjoyed considerable success operating from U.S. Navy ships during Desert Storm. "The following example provides some insight into how effective a Hellfire armed helicopter can be. Before the USS *Missouri* (BB-63) and the USS *Wisconsin* (BB-64) could move into the battleship fire support area, Silkworm missile sites on Faylakah Island and the Kuwaiti coast had to be knocked out. Thirteen raids over two days by carrier-based aircraft on Faylakah Island came to no avail. The decision was then made to allow the USS *Jarret's* OH-58Ds and LAMPS IIIs to reconnoiter the island and destroy the sites if they could be found. Battle damage assessment was to be provided by the *Missouri's* Pioneer remotely piloted vehicle and OH-58D forward looking infrared (FLIR) recordings of the mission. The OH-58Ds found the site and destroyed it with one Hellfire missile. What two days of tactical aviation raids had failed to destroy was thus eliminated by armed helicopters in

less than 20 minutes. The result; the battleships moved into position and pummeled the Enemy.[42]

The OH-58D's demonstrated ability has led to the U.S. Army development of "deep" strike doctrine for the Kiowa Warrior.[43] Additionally, the U.S. Navy, recognizing the utility and necessity for using armed helicopters in littoral operations, developed detailed procedures for the shipboard employment of the OH-58D.[44]

AGM-114 Hellfire Missile System

Now that a basic understanding of the roles and capabilities of helicopters employing the Hellfire missile has been established, a more detailed description of the capabilities of the Hellfire missile will aid a later discussion of the role of the Seahawk using the weapon in overland littoral strike warfare. The AGM-114 Hellfire was designed in the 1970s as a multimission antiarmor and precision attack weapon. The Hellfire was first successfully test fired in 1978, and the first operational missiles were delivered to the Army in 1984.

The name Hellfire is an acronym for heliborne, laser, fire, and forget. The name can be misleading, fire and forget implies that the missile acquires the target and autonomously guides itself. In actuality, the missile acquires an active laser source and follows the reflected laser energy to the point of impact. The firing aircraft or remote source must positively control the laser designation until impact. Current semiactive laser-guided versions of Hellfire are not truly fire and forget weapons. The millimeter-wave radar-guided Hellfire missiles of the Apache Long Bow system in development can be accurately described as fire and forget.

The family of Hellfire missiles is broken into four generations: basic Hellfire AGM-114A/B/C and antiship Hellfire, interim Hellfire (AGM-114F), Hellfire 2 (AGM 114K), and Long Bow Hellfire. Since this paper is focused on the use of the missile with the Seahawk helicopter, only the first three generations will be discussed. Regardless of the generation of the missile, Hellfire is of modular construction made up of five major sections: seeker, warhead, guidance, propulsion, and control. The AGM-114A was the first production version of the missile. The AGM-114A is 1.63 meters long (64 inches), has a178-millimeter (7-inch) diameter, has a wingspan of 0.33 meters (13 inches), and has a launch weight of 46.5 kilograms (99.5 pounds).[45] The missile has a semiactive laser-homing guidance system, 8-kilogram shaped charge warhead with an impact fuse. The AGM-114A has a range of 8 kilometers. The AGM-114B was developed for the U.S. Marine Corps and is identical to the AGM-114A with the following exceptions: AGM-114B includes improved low visibility capability and a safe arming switch to make the missile shipboard capable, flies a lower trajectory than the AGM-114A, and contains a minimum-smoke rocket motor. The AGM-114C was developed for the Army and includes all the improvements of the AGM-114B, except the safe-arming switch for shipboard use. Antiship Hellfire is identical to the AGM-114B, except the missile has contains a high explosive/blast/fragmentation warhead. The AGM-114F, known as interim Hellfire, is an improved version of the AGM-114C to include warhead improvements to make the missile effective against reactive armor. Like the AGM-114C the AGM-114F is not certified for shipboard use. The Hellfire II, AGM-114K, like the AGM-114F, has a warhead effective against reactive armor and has improved capability

for the missile reacquiring a target if the missile flies into low clouds. The AGM-114K is certified for shipboard use.[46]

Hellfire Employment Considerations

There are two basic Hellfire engagement methods: autonomous laser designation and remote laser designation. Autonomous designation requires the launching aircraft to designate the target until missile impact. Remote designation requires another aircraft or ground team to designate the target for the missile until impact. Using remote designation may allow the launch aircraft to remain masked by terrain, therefore increasing launch aircraft survivability. Remote designation engagements, however, require considerable coordination. The remote designator must have the proper laser code for the missiles being used, the launching aircraft and remote-designating source need to be aware of each other's location, bearing to target, launch bearings and ranges. Care must also be exercised not to exceed the maximum designator offset angles and not to launch within the remote designator safety zone. Unimpeded two-way radio communications between designation source and the launch aircraft, as well as well-established engagement procedures understood by both parties are a prerequisite for successful remote engagements.[47]

There are four selectable Hellfire launch modes: Lock on Before Launch (LOBL), Lock on After Launch Direct (LOAL-DIR), Lock on After Launch-High (LOAL-HI), and Lock on After Launch-Low (LOAL-LO). The selection of launch mode depends on a variety of factors, the designation method, distance to the target, the weather (visibility and cloud ceiling), and the terrain conditions under which the missile will be fired. These

factors require thorough preflight planning, particularly with earlier generations of the Hellfire that might lose lock and be lost if they fly into clouds.

With LOBL, the missile laser seeker acquires and locks on the coded laser energy reflected from the target prior to the launch. The advantage to LOBL is that the crew is assured that the missile has already positively locked prior to launch from the aircraft, and as a result the missile has a higher probability of hit. The disadvantages of LOBL are that the missile flies the second highest trajectory of all modes. The maximum height of the missile's trajectory increases with the distance to the target. Thus, long-range LOBL shots require high cloud ceilings. Additionally, an aircraft using an autonomous designation must be unmasked to the target for the duration of the missile's flight. This is a significant disadvantage when attacking well-defended targets considering that the Hellfire's time of flight exceeds 35 seconds at maximum range.[48]

The LOAL-DIR can be used to lower the missile's trajectory. When using LOAL-DIR the missile is launched in the direction of the target before laser designation. The missile will fly a low trajectory unguided profile until, at a predetermined time, the target is laser designated. Once the missile acquires the reflected laser energy, it will pitch up in order to attack the target at the optimum dive angle. A disadvantage of using LOAL-DIR is the possibility that the missile will not acquire the reflected laser energy from the target, particularly if the designation is unduly delayed.[49]

The LOAL-HI and LOAL-LO launch modes allow the launch aircraft to remain masked behind terrain. Used with remote designation, these methods provide the greatest degree of protection to the launch aircraft. When using LOAL-HI mode the missile can clear a 1,000-foot terrain feature. The LOAL-HI has the highest trajectory of all launch

modes and thus requires high cloud ceilings. Using LOAL-LO the missile can clear a 260-foot terrain feature and requires a minimum of a 600-meter standoff. The missile will fly a somewhat lower trajectory than that of LOAL-HI.[50]

Hellfire's Performance in Desert Shield and Storm

During Operation Desert Storm, Hellfire missiles were effective against a variety of targets other than tanks. Hellfire was reported to be effective against armored vehicles, tanks, bunkers, bridges, and artillery systems.

> An initial assessment of interviews with pilot/gunners who fired 200 missiles showed a hit rate of about 65 percent. In addition, data compiled by the Hellfire project office on 71 missiles fired by six different units between October 1990 and February 1991 showed an average hit rate of about 79 percent. The individual unit hit rates ranged from 25 to 100 percent. . . . At least two units improved significantly after receiving additional training. . . . The army found that pilot/gunners were not using techniques designed to maximize Hellfire's accuracy in the presence of obscurants. . . . Once proper techniques were employed units' hit rates increased to about 90%.[51]

Overall, about 2,880 Hellfire missiles were fired in the Gulf War with a probability of hit greater that 75 percent.[52] Some Apache helicopters experienced problems with uncommanded missile firings caused by faulty wiring and switches, which have since been corrected. Not withstanding initial training problems, and isolated uncommanded missile firings, the Hellfire was and overwhelming success. This success is reflected by numerous requests for purchases of the missile, and the aircraft that deliver it, by coalition countries following the war.[53]

Hellfire for Navy Seahawks

In 1992, the Navy white paper *From the Sea* signaled a shift in focus for naval operations from bipolar war on the high seas to power projection in the littoral regions of

the world.[54] Two years later the Navy published the white paper *Forward . . . From the Sea* refining the basis of naval doctrine to include operations other than war, specifically engaging in forward areas with the objectives of preventing conflicts and controlling crises. The paper states, "In many critical situations, U.S. naval forces alone provide theater commanders with a variety of flexible options-including precise measures to control escalation-to respond quickly and appropriately to fast-breaking developments at the operational and tactical level."[55] This doctrinal shift set the stage for arming Navy helicopters.

The U.S. Navy first experienced the implications of modern littoral warfare in 1987 during Operation Earnest Will, when the Navy was tasked with patrolling the waters of the Persian Gulf and with protecting of U.S.-flagged Kuwaiti tankers. This operation highlighted a serious shortcoming of the Navy with respect to fighting in the littorals. The Navy lacked night-vision capability, and Navy helicopters were unable to counter the small boat threat. As a result, numerous small attack boats of the Islamic Revolutionary Guard Corps (IRGC) operated with impunity at night. To rectify the Navy's lack of capability, Army MH/AH-6 helicopters from the 160th Special Operations Aviation Group, equipped with night-vision devices and weapons effective against the threat were deployed to support the operation. The MH/AH-6 helicopters operated from Navy ships in conjunction with the Navy's Seahawk helicopters. The Seahawks provided command and control for the Army helicopters. The impact of the new capability was quickly realized as the helicopters captured an Iranian ship in the act of laying mines and destroyed several small attack boats. As a result of this success, the IRGC stopped

attacks in the northern Gulf, and restricted its operations to daytime attacks in the southern Gulf.[56]

Based on the experience of Operation Earnest Will, the Navy realized the need for night-vision-equipped armed helicopters. As discussed earlier, during Desert Shield and Storm this need was successfully filled by the Army's OH-58D. However, "Post-Desert Storm combined training among U.S. Army Kiowa Warriors, LAMPS IIIs, and Navy ships was not sustained. The inability to institutionalize the solution to a very real requirement led the Navy to act independently to request funding to procure an in-house, cost-effective, off-the-shelf capability for its helicopters."[57]

The requirement for armed helicopters on Navy ships was realized not only by the Navy: "The CINCs want flexibility in responding to conflicts and have requested armed naval helicopters through JSCP inputs."[58] The mission requirement for armed naval helicopters is aimed at countering the small boat threat. If armed helicopters could defeat the threat, then tactical fixed-wing aviation could be released from the mission allowing them to perform more important missions. The argument on how to fill the requirement centered on several key issues including cost, availability, and shipboard compatibly. The cheapest option was to use Army or USMC existing attack helicopters to meet the requirement. The use of nonorganic attack helicopters, however, could not provide the required flexibility. Army and particularly Marine attack helicopters are a limited resource and could not be dedicated to deploy routinely with naval surface forces. Thus, their use in crisis response would require lead time to deploy the assets, thereby reducing flexibility of naval forces to respond. Additionally, Army helicopters are not completely compatible for shipboard use. The aircraft do not have link capability with the surface

ships and are not corrosion resistant, and in many cases their weapons are not shipboard capable.[59] Marine Cobra helicopters, while shipboard compatible, are not suitably compatible with small surface combatants. Cobras will not fit completely into the hangers of surface combatants, and due to skid landing gear, aircraft handling would be precluded in rough seas.

The Navy decided in 1996 that the use of Army and Marine attack helicopters was not a viable option for filling the Navy's requirement for armed helicopters. Instead, the Navy chose to arm its Seahawk helicopters. The most cost-effective solution was to use off-the-shelf technology. The Hellfire missile with the enhanced weapons kit described in chapter 2 was the solution of choice. In January 1999 the first Seahawks, HH-60Hs modified for the EWK, were given flight clearance to operationally fly with and fire the Hellfire missile.[60]

The literature review provided a wealth of information concerning the capabilities and uses of Hellfire-armed helicopters and the Navy's need for the capability. Attack helicopters have demonstrated superb capability for attacking land targets independently. The literature review, however, did not provide insight into the Navy's planned or theorized use of the new capability in an overland strike role. The focus of the research will be to determine if the Seahawk with Hellfire has similar ability and if the ability is established does the Seahawk have a role in overland strike warfare with in the framework of the Carrier Battle Group's power projection capability.

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CHAPTER 4

RESEARCH METHODS

The plan to answer the research question, Do Navy Seahawk helicopters, employing the Hellfire missile system, have a role in littoral overland strike operations? was divided into two phases. Phase I entailed gathering information to support a descriptive and subjective analysis of the capabilities, effectiveness, aircrew training programs, and tactics of Hellfire-armed helicopters with existing roles in overland strike operations. Similar information was gathered on the SH-60B and HH-60H Seahawk helicopters. Phase I information is used to support a comparative analysis between navy Seahawks and proven Hellfire-armed helicopters in chapter 5. Phase II focused on obtaining the views of naval leadership concerning the relevance and applicability of using the Seahawk in an overland strike role.

Literature Search

The initial stage of phase I involved a comprehensive search for scholarly literature related to the topic. A search of the Defense Technical Information Center (DTIC) database was performed to locate work on and related to the subject. Unfortunately, nothing could be found directly relating to the use of Navy Seahawks in an overland strike role. The author was, however, able to obtain unpublished papers, which argued for the need to arm Navy helicopters. These works primarily argued the need to arm Navy helicopters to perform an overwater strike role.

The research continued with a search of the Center for Army Lessons Learned (CALL) database for information relating to the Army's use of the Hellfire missile system. Additional information on the capabilities, effectiveness, aircrew training, and

employment tactics for attack helicopters was derived from numerous sources including books, periodicals, U.S. Army field manuals, naval warfare publications, U.S. Government surveys, U.S. General Accounting Office reports, and internet sources. In situations, which the collected data conflicted, government sources were used. This research yielded an abundant amount of information to support the analysis.

Information concerning the capabilities, aircrew training programs, and tactics for Seahawk helicopters employing the Hellfire was more elusive. The information was gathered from naval warfare publications, periodicals, Navy training instructions, and Internet sources. A web site, developed by the Navy H-60 program manager's office (PMA-299), was particularly useful for obtaining technical information concerning the Navy's armed helicopter program. Tactics for Seahawk employment of the Hellfire missile, at the time of the research, were under development and therefore not published.

The information gathered during phase I of the research is used to support the analysis in chapter 5. Phase I research was designed to answer the following subordinate research questions: (1) Is the Seahawk properly equipped to employ the Hellfire missile in overland strike missions? (2) Are Seahawk crews properly trained to perform the mission? and (3) Can existing Army and Marine Corps tactics for Hellfire employment be used or modified for use by Navy Seahawks?

Interviews

Phase II of the research involved conducting interviews with Navy leadership and subject matter experts to ascertain their views on the applicability of using Seahawks in overland strike warfare. Interviews of naval leadership were targeted towards those leaders who are involved in deciding the role, if any, the Seahawk will have in overland

strike operations. The officers meeting these criteria included Carrier Group (CARGRU) commanders, Carrier Air Wing (CVW) commanders, Destroyer Squadron (DESRON) commanders, Helicopter Antisubmarine Wing commanders, Helicopter Antisubmarine (Light) Wing commanders, and squadron commanding officers.

Interviewees were provided the following notional scenario for the employment of Seahawks in overland strike operations and an initial interview question outline.

Notional Scenario for Employment of Seahawks

The following scenario was developed to stimulate discussion of possible roles for the Navy H-60 helicopter, armed with the Hellfire Missile, in overland strike operations. The scenario uses HH-60H helicopters in a limited role to attack high value targets. The scenario envisions a section of HH-60H aircraft covertly ingressing into enemy territory to destroy key targets with Hellfire missiles. In the case of the HH-60H, the only difference between the scenario and the helicopter's current required operational capabilities is that the helicopter delivers weapons on target. HH-60H aircraft are currently tasked with the ability to covertly enter enemy territory to perform combat search and rescue (CSAR) and naval special warfare support (NSWS) missions. Conversely, the SH-60B does not currently have an operational requirement to perform overland operations in enemy territory.

The recent enhancement of Navy H-60 capability, given the addition of forward looking infrared sensors, laser designation capability, and the Hellfire missile system, provides the aircraft the ability to attack overland targets. The scenario presented is not intended to represent a validated capability of the H-60, but it is intended to stimulate discussion of possible roles for Hellfire armed Seahawks in overland strike operations.

The interview questions listed below are intended to sample the views of Navy leadership concerning current and potential roles, if any, of HH-60H and SH-60B helicopters in overland strike operations.

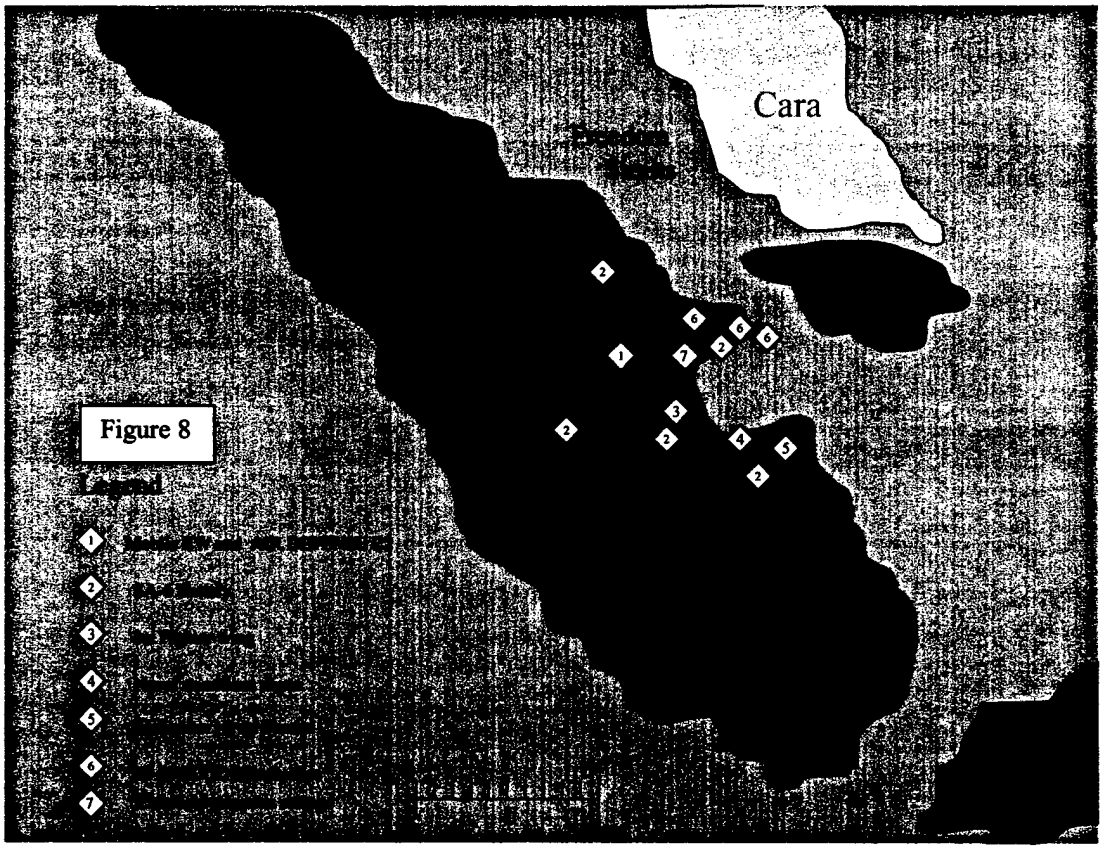
Scenario

The long-lasting territorial dispute over the island of Luma between the nations of Karhu and Cara has developed into a heated crisis. Karhu has laid claims on Luma and has established a naval blockade of the island, and declared a maritime exclusion area in Freedom straits. Karhu has threatened to sink any vessel that attempts to navigate the Freedom Straits without the prior approval of the Karhunian naval headquarters. The United States and the United Nations has condemned the action and called for the immediate withdrawal of the Karhunian Naval Forces. Karhu has threatened further escalation if the United States or the UN intervene. Karhu has moved its SS-1 Scud missiles within striking range of Cara and Luma, and appears to be preparing its army for an amphibious assault.

The United States has significant strategic interests in Luma. Luma is the commercial nerve center of the Western Pacific, and houses a key naval repair and logistics base for the US Navy. The Nimitz carrier battle group was recently ordered to the region, and is the only U.S. military force in theater.

Karhu has abandoned UN peace negotiations and appears to be preparing to invade Luma. The NCA has directed USPACOM to reestablish freedom of navigation in Freedom straits, and to destroy Karhu's weapons of mass destruction and its ability to strike Cara and Luma. USPACOM has assigned the Nimitz battle group commander as the Joint Task Force commander for the operation code-named Pacific Thunder.

The situation is rapidly deteriorating. The NCA has directed strikes to begin as soon as possible; as a result, Pacific Thunder must begin before additional forces can be deployed to support the operation. The JTF commander has approved the following basic plan of action. The USS *Chancellorsville* (CG-62) and USS *Princeton* (CG-59) will enter the Freedom straits to provide TBM and air defense for the straits Luma and Cara. During the offensive phase of Pacific Thunder, the cruisers will also engage the blockading Karhunian naval forces. The USS *Pasadena* (SSN-752) and USS *Boise* (SSN-764) will establish patrols in Freedom Straits between Karhu and Luma, once strike operations begin, they will conduct offensive operations to destroy Karhunian naval forces. The remainder of the battle group will conduct strike operations against Karhu from operations areas off Karhu's West Coast (figure 8).



Strike Concept of Operations

Target List
1st Fighter Wing (24 Mirage F-1s)
Chemical Weapons Storage Facility
Scud missiles and launchers
Naval mine storage area (Hardened Bunkers)
Air defenses (5x SA-6 Batteries)
Mine laying ships (pier side Karhu naval base)
Air defense C2 and EW
Amphibious ships (6xLST, 2xLSD, 2xtroop carriers pier side Karhu naval base)
Karhu's blockade surface naval forces (3x Destroyers, 8x Frigates, 13 x Corvettes)

The concept of operation is for a night strike to swiftly destroy Karhu's power projection capability. A night strike will reduce the risk to U.S. forces from Karhunian Airforce, AAA, and MANPAD threats. The Karhunian airforce does not train for night operations regularly and has limited night fighting capability.

Surprise is essential to prevent Karhu from launching a chemical attack or mining the Freedom straits in response to warnings of the US attack. Mission objectives require every asset available to be employed in the first night of strike operations. Surprise will be achieved by using Hellfire-armed HH-60Hs to destroy elements of Karhu's integrated air defense system (IADS), particularly, early-warning radar systems. A nearly simultaneous TLAM strike will be used to strike Karhu's Airforce base and chemical weapons production and storage facilities. Naval TACAIR will suppress/destroy Karhu's SAM batteries, destroy the Naval mine storage area, the 1st Fighter wing and airfield at Java, Scud Missiles/Launchers, and Naval forces pier side at Karhu.

A Role for H-60s Armed with Hellfire

The central West Coast of Karhu is a sparsely populated mountainous region. A two helicopter HH-60H detachment, from the Nimitz HS squadron, is swapped with the Lamps MKIII detachment on the USS Thatch (FFG-43). The HH-60H detachment includes four aircrews. Two crews will be used for the initial strike, the remaining crews will hot seat the aircraft to assume a CSAR alert. The Thatch will discreetly approach Karhu's West Coast in commercial shipping lanes using electronic emission control and deceptive lighting procedures.

The Thatch will launch the HH-60Hs at a distance of 15NM from the Karhu coast. The HH-60Hs mission is to ingress covertly, at night, and destroy key elements of Karhu's SAM regimental head quarters and target acquisition battery located in the mountains 30 kilometers west of the capital Java. Karhu's air defenses rely heavily on centralized command and control. Specific targets assigned to the HH-60H mission are one 9S470MI command post vehicle, one Long Track surveillance radar vehicle, and Spoon Rest surveillance radar vehicle. Karhu has been randomly relocating these vehicles in the HQ area in an apparent attempt to protect from TLAM and other GPS guided weapons attack.

The HH-60H was chosen for this mission due to its ability to ingress undetected using terrain masking and its ability to locate and attack desired targets (armed reconnaissance). Each HH-60H will be armed with four AGM-114 Hellfire missiles. Remote engagement tactics will be used to engage the targets. One HH-60H will launch the Hellfire missiles, using lock on after launch mode (LOAL) from a position masked by terrain. The other HH-60H will unmask, offset from the firing helicopter, and laser-

designate the targets for the Hellfire missiles. This procedure will allow the firing helicopter to remain masked by terrain during the missile launch, thus reducing the possibility that enemy forces can target the launch helicopter by observing the missile's motor ignition. Based on battle damage assessment, the helicopters may switch roles and attack the targets again. The HH-60H aircrews, in the near future, will have the ability to report real time battle damage assessment to the carrier located 200mn to the west using SATCOM.

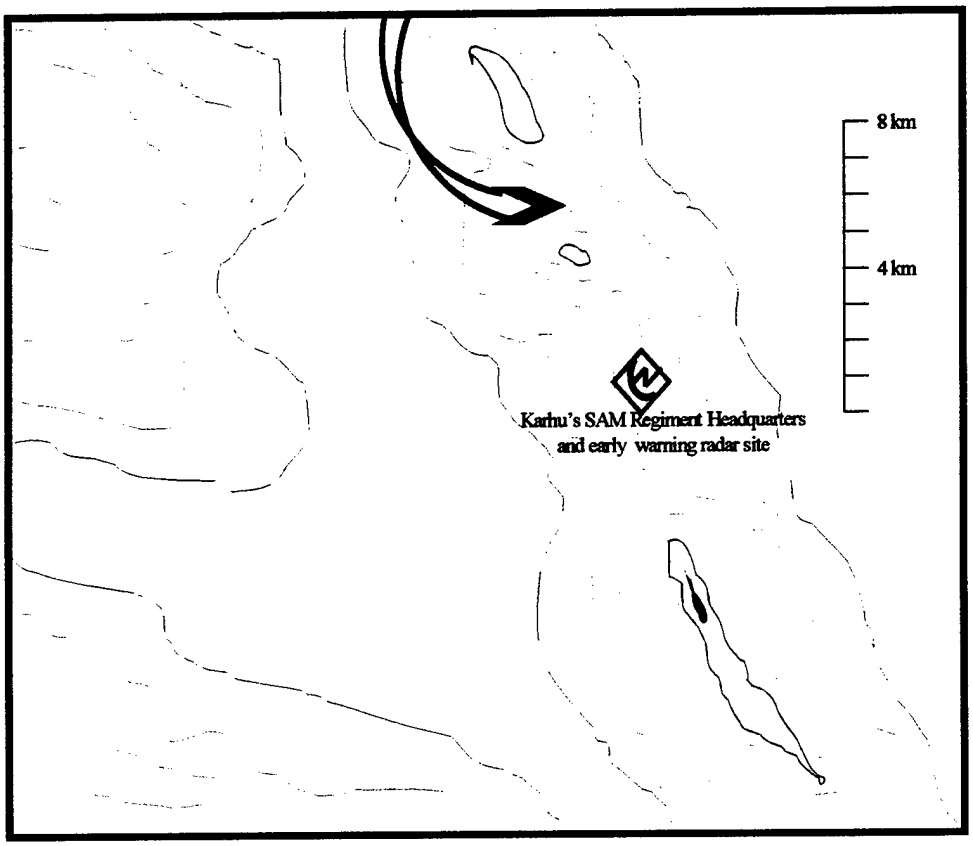


Figure 9. Diagram of Karhu's SAM Regiment Headquarters and Early Warning Radar Site

Successful completion of the HH-60H mission will significantly degrade Karhu's air defenses, allowing the carrier TACAIR greater capability to complete the strike objectives with minimum losses. Additionally, using HH-60Hs in this limited strike role serves as a force multiplier for the carrier air wing, allowing assets which otherwise would have been dedicated to these targets to be focused elsewhere

Interview Question Outline

1. Does the HH-60H, armed with Hellfire, have a role, or a potential future role, in overland strike operations?
    a. If so, which roles do you see the helicopter being used?
    b. If not, why doesn't the helicopter have a role?
2. Does the SH-60B, armed with Hellfire, have a role, or a potential future role, in overland strike operations?
    a. If so, which roles do you see the helicopter being used?
    b. If not, why doesn't the helicopter have a role?
3. Are there any issues that need to be resolved before HH-60H helicopters can have a role in overland strike operations?
4. Are there any issues that need to be resolved before SH-60B helicopters can have a role in overland strike operations?
5. Do current training programs sufficiently train H-60 aircrews for overland strike operations? If not, what improvements are required?

Phase II of the research was designed to determine how Navy leadership views the role of Seahawk's in overland strike operations and to gather information to answer the subordinate research questions of: (1) Is the use of the Seahawk prudent given other

weapon systems available to the Carrier Battle Group? (2) Are current Navy training programs sufficient for training crews for overland strike operations? and (3) If training is not sufficient, what additional training would be required?

The research examined classified and unclassified documents. Only unclassified sources were used in order to eliminate the administrative complications of producing a classified thesis and to maximize the ability to disseminate the thesis. In the author's opinion, eliminating classified sources did not diminish the value of the research.

Phase I of the research process was unfortunately unable to discover literature examining the relative effectiveness of attack helicopters compared to fixed-wing strike aircraft. Such information would have been extremely useful in answering the research questions. Phase I did, however, yield enough information to support an analysis to answer the research questions. Phase II, was not able to obtain the views of all leaders in the targeted leadership positions. Deployment schedules, lack of interest in the subject, and competing demands for these leaders' time were factors which lead to less than comprehensive results. However, some leaders from each targeted position provided valuable insight into the issues affecting the research.

CHAPTER 5

ANALYSIS

In this endeavor to determine what role, if any, Seahawk helicopters play in littoral overland strike operations, subordinate research questions must first be answered. This chapter will answer the subordinate questions by analyzing the Seahawk's performance, mission equipment, weapons, and aircraft survivability equipment compared to the those of helicopters with existing overland strike roles. Helicopter antisubmarine (HS) and helicopter antisubmarine (light) (HSL) training programs will be compared to those of the Army and Marine Corps training programs for attack helicopters. Army and Marine Corps overland strike tactics will be analyzed to determine applicable use by Seahawk helicopters. Existing HH-60H tactics for naval special warfare support (NSWS) and combat search and rescue (CSAR) will be examined for incorporation into overland strike tactics. And finally, the views of naval leadership will be discussed to determine the applicability of using the Seahawk in overland strike operations.

Equipment

Are Seahawks sufficiently equipped for overland strike operations? A comparison of the equipment and performance of theAH-64, AH-1W, OH-58, HH-60H, SH-60B, and SH-60F is a useful tool to begin answering this question. The AH-64, AH-1W, and OH-58 helicopters have demonstrated the capability to conduct overland strike operations and thus are assumed to be properly equipped for the mission. Table 2 provides a summary of the performance and equipment of the helicopters. The summary

of the helicopters performance and equipment (table 2) clearly illustrates that the various series of Navy H-60 helicopters are equipped quite differently; therefore, each series (SH-60B, SH-60F, and HH-60H) will be examined separately to determine if it is properly equipped for overland strike operations.

Table 2. Aircraft Equipment Profiles

		AH-64	AH-1W	OH-58D	HH-60H	SH-60B	SH-60F
NAVIGATION	GPS		X	X	X	X	X
	DOPPLER	X			X	X	X
	INS		X	X			
COMM	V/UHF	X	X	X	X	X	X
	HF	X			X	X	X
	SATCOM				X		
	SECURE VOICE	X	X	X	X	X	X
	FREQUENCY HOPPING	X		X			
	DATA LINK	X			X		X
NIGHT VISION	FLIR	X	X	X	X	X	NOTE 1
	NVG	X	X	X	X		X
	HEADS-UP DISPLAY	X	X		X		
TARGETING	FLIR	X	X	X	X	X	NOTE 1
	DAY TV	X	X	X			
	OPTICAL	X	X	X			
	LASER	X	X	X	X	X	NOTE 1
ASE	RADAR WARNING RECIEVER	X	X	X	X	NOTE 2	
	MWS "PLUME DETECTOR"		X		X	NOTE 2	
	CHAFF/FLARE DISPENSER	X	X		X	NOTE 2	
	IR JAMMING	X	X	NOTE 3	X	NOTE 2	
	HIRSS IR REDUCTION				X		
	WIRE STRIKE PROTECTION			X	X		
	LASER WARNING		X	NOTE 3			
WEAPONS	HELLFIRE (max # of missiles)	16	8	4	4	4	
	ROCKETS	X	X	X			
	GUNS	30MM	20MM	.50CAL	7.62MM	.50 CAL	7.62MM
	AIR-TO-AIR STINGER			X			
	SIDEWINDER/SIDEARM		X				
PERFORMANCE	MAX CRUISE(KTS)	150	150	114	150	150	150
	COMBAT RADIUS(NM)	150	150	65	250	250	300

NOTES
1. Programmed for EWK in FY02
2. Some BLK 1 upgrade SH-60Bs
3. Some retrofitted OH-58Ds

There are no doctrinal criteria to determine if a helicopter is sufficiently equipped for overland strike operations. For the purpose of the following analysis, each series of Seahawk will be subjectively compared to the OH-58D. The OH-58D is used as the

baseline for comparison because the helicopter has combat proven effectiveness for overland strike, and the helicopter is the least extensive equipment package of the helicopters with established roles of overland strike with the Hellfire. The goal of the analysis is not to determine if the Seahawk is as well equipped as the most sophisticated attack helicopters. It is to determine if the helicopter is sufficiently equipped to perform an overland strike role.

HH-60H/OH-58D

The HH-60H is the best-equipped Seahawk for overland operations. This statement is not surprising due to the fact that the helicopter was designed to perform an overland mission in hostile territory. The HH-60H compares favorably to the OH-58D. The HH-60H outperforms the Kiowa Warrior in terms of speed and range. Like the OH-58D, the HH-60H has precise navigation capability with its imbedded GPS navigation system. The HH-60H has superior navigation capability in instrument meteorological conditions (IMC). The HH-60H communications equipment compares favorably as well. While the HH-60H does not have the Have Quick II frequency hopping, but its SATCOM and HF radio gives superior long-range communication ability. Arguably, Have Quick frequency hopping capability is not a mission essential requirement for overland strike operations since the AH-1W, another combat proven helicopter, does not have this capability. Additionally, the HH-60H has adequate secure voice capability with KY-58 encryption.

The HH-60H and OH-58D both use night-vision goggles (NVG) and forward-looking infrared (FLIR) for night vision. The HH-60H has superior night vision capability with its NVG heads-up display. The OH-58D has superior daytime targeting

equipment with its television sighting system. Lack of this capability in the HH-60H is not considered to be a significant mission detractor because the FLIR system can also be used for daytime targeting. It should also be noted that the HH-60H would be used primarily for night missions.

The HH-60H has sophisticated aircraft survivability equipment (ASE). The ASE system components are fully integrated and provide state of the art protection. The HH-60H clearly has more extensive ASE than the OH-58D.

The OH-58D has the ability to carry ATA Stinger missiles, Hellfire missiles, 70-millimeter rockets, and a .50-caliber machine gun. At first glance, it appears that the Kiowa Warrior has superior weapons capability to that of the HH-60H. However, in a closer analysis, an OH-58D armed for a strike mission with four Hellfire missiles can carry no additional weapons. Again, Kiowa warriors armed with four Hellfire missiles have a well-established role in overland strike. The HH-60H with four Hellfire missiles and two 7.62-milllimeter miniguns has a superior weapons configuration than a strike configured OH-58D.

The HH-60H compares very favorably with the OH-58D. With the HH-60H having superiority in most areas. Based on this analysis it can be determined that the HH-60H is sufficiently equipped for overland strike operations.

SH-60B/OH-58D

Unlike the HH-60H, the SH-60B was not designed to perform overland missions in hostile territory. The SH-60B was designed primarily as a sea control helicopter. Comparison of the SH-60B to the OH-58D yields somewhat different results. Like the HH-60H, the SH-60B outperforms the Kiowa Warrior in terms of speed and range. The

SH-60B communication equipment also compares favorably with the OH-58D. The SH-60B does not have frequency hopping capability, but it has greater long-range communications capability with its HF radio. The SH-60B has precise navigation capability with GPS.

The SH-60B night vision capability currently compares unfavorably with the Kiowa Warrior. Its only night vision capability comes from dash-mounted FLIR imagery. However, NVG compatible cockpit conversion kits and NVGs are programmed improvements for the SH-60B. Like the HH-60H, the SH-60B lacks daytime television targeting capability. Thus, daytime targeting is less effective than the OH-58 but can be accomplished with FLIR.

Only some SH-60B helicopters are equipped with aircraft survivability equipment (ASE). Block I upgrade aircraft with radar warning receiver, missile warning system, chaff/flare dispensers, and infrared-jamming capability compare favorably to the ASE of the OH-58D.

The weapons systems of the SH-60B also compare favorably compared to a strike configured (four Hellfire missiles) OH-58D. The SH-60B carries four Hellfire missiles and one crew-served, door-mounted, .50-caliber machine gun.

The SH-60B compares unfavorably to the OH-58D in two key areas. Not all aircraft are equipped with ASE, and the SH-60B currently does not use NVGs. Determining if the SH-60B is sufficiently equipped for overland strike is therefore less clear. The SH-60B aircraft with NVGs and ASE would compare favorably to the OH-58D and would therefore be considered sufficiently equipped. Aircraft lacking NVGs

and ASE compare unfavorably and therefore are not sufficiently equipped for overland strike operations.

SH-60F

An in-depth analysis of the SH-60F to determine if it is sufficiently equipped for overland strike operations is obviously fruitless. The SH-60F, at the time of writing this thesis, does not have the FLIR and Hellfire system upgrade. The upgrade is programmed for fiscal year 2002, but is not funded. Thus without a strike weapon, the SH-60F obviously is not sufficiently equipped for overland strike operations. Analyzing the future capability after a FLIR/Hellfire upgrade yields a critical shortfall in ASE. The SH-60F is not equipped with a radar-warning receiver, chaff/flare dispenser, missile warning system, or infrared jamming capability. The SH-60F would be extremely vulnerable to enemy air defense systems. A FLIR and Hellfire-equipped SH-60F would compare unfavorably with the OH-58 in this critical area. Therefore, the SH-60F is determined not to be sufficiently equipped for overland strike operations.

The question, Are Seahawks sufficiently equipped to perform overland strike missions? is answered in three parts. Based on a comparative analysis of the Seahawk to the OH-58D, the HH-60H is sufficiently equipped to perform the mission. The SH-60B aircraft equipped with a full ASE package and NVGs are sufficiently equipped for the mission, while other SH-60B aircraft not so equipped are not. And finally, the SH-60F is not sufficiently equipped for overland strike.

Training

Are Seahawk aircrews properly trained for overland strike missions? If the aircrews are not adequately trained, what additional training is required? To answer these subordinate research questions, the current training programs for the Army Apache, Kiowa Warrior, and the Marine Corps Super Cobra were examined and compared to the current training programs for the Helicopter antisubmarine (HS) and the helicopter antisubmarine (light) (HSL) communities. A comprehensive list of aircrew tasks for AH-64 and OH-58D was taken from Army aircrew training manuals, TC 1-214, *Attack Helicopter, AH-64*, and TC 1-209, *Observation Helicopter, OH-58D.* A list of aircrew tasks for the AH-1W helicopter in overland operations was taken from the Marine Corps *Interim Training and Readiness* manual, volume 3. The HS and HSL training syllabi and the combat search and rescue (CSAR) policy and advanced syllabus for helicopter antisubmarine (HS) (COMHSWINGPAC/COMHSWINGLANT Instruction 3710.3D) were examined to determine which of the identified tasks were currently incorporated into existing training programs. Tasks involving overwater employment of the Seahawk were not included in the comparison. The results are depicted in the appendix. The analysis is used to compare the current training of HS and HSL aircrews to the standards set by agencies operating helicopters with an established overland strike role.

In determining if HH-60H aircrews are properly trained for an overland strike, criteria similar to that used for determining if the aircraft is properly equipped, was used. The required aircrew tasks for the OH-58D is compared against the tasks that HS, HH-60H CSAR qualified, aircrew are currently trained to perform. The comparison identified the tasks in which HH-60H aircrews do not currently train to perform (table 3).

Some of the tasks identified are considered airframe specific tasks, or aircrew tasks, which are directed at operating a specific piece of equipment. Other tasks are identified as mission related tasks, or tasks, which are directed at performance of a particular mission not operating aircraft equipment.

Table 3. OH-58D aircrew tasks not included in HH-60H training

Airframe specific tasks
Perform analog throttle operation
Perform VAPI approach
Operate air-to-air Stinger system
Operate .50 caliber machine gun
Conduct a fire-for-effect mission using MMS and ATHS
Conduct a suppression mission using MMS and ATHS
Conduct a immediate suppression mission using MMS and ATHS
Mission specific tasks
Identify major U.S. or allied equipment and major threat equipment
Perform firing position operations
Perform target hand over procedures
Perform aerial observation
Perform a route reconnaissance
Call for and adjust indirect fire
Reconnoiter and recommend a holding area
Perform a security mission
Call for and control a tactical air strike
Perform an area reconnaissance
Perform techniques of movement
Call for and designate for Copperhead LGM

The airframe specific tasks are included in the discussion solely to allow for a comprehensive comparison of all required OH-58D aircrew tasks to the tasks for which Navy HH-60H aircrews are currently trained. These tasks are directed at operating equipment specific to the OH-58D and are not considered to have bearing on the evaluation of HH-60H aircrew training.

The mission specific tasks identified in table 3 represent the tasks which OH-58D aircrews are expected to perform which have a significant bearing in determining if HH-60H aircrews are properly trained for an overland strike mission. At first glance, it appears that HH-60H aircrews lack training in an extensive list of tasks. However, not all these tasks are related or required tasks for overland strike operations. The OH-58D performs many missions other than strike. Many of these missions involve direct support of ground forces, such missions directing and targeting for indirect artillery fires, performing reconnaissance, and security operations for ground maneuver forces. These missions, by their nature, are performed in conjunction with ground forces established in a theater. The HH-60H aircrews are obviously not adequately trained for this type of employment. However, this type of mission is not the focus of this research. The question that remains is, Which of the OH-58D tasks identified should be included in HH-60H training for overland strike?

In determining what additional training is required for HH-60H aircrews, it is helpful to revisit the discussion in chapter 1. This research is aimed at determining if the Seahawk can perform a limited overland strike role, and it is assumed that the Seahawk would primarily perform the role when Marine Corps and Army attack helicopters are not available. A logical progression to this assumption is that if Marine Corps and Army helicopters are not in a theater, neither are Army or Marine Corps ground forces. Using the above assumptions, it follows that there is no need to train HH-60H aircrews to every task that the OH-58D performs. Specifically, tasks that directly support ground forces can be eliminated from the list of tasks HH-60H aircrews should train to perform.

After eliminating aircrew tasks which are designed to directly support ground forces, the following list of OH-58D task remain as training shortfalls for the HH-60H aircrews:

1. Identify major U.S. or allied equipment and major threat equipment.
2. Perform firing position operations.
3. Perform target hand-over to attack helicopter.
4. Perform aerial observation.
5. Call for and control a tactical air strike.
6. Perform techniques of movement.

A brief discussion of these six tasks considered to be training shortfalls, when comparing the HH-60H training program to the OH-58D training program, is useful in evaluating the impact of including these tasks in HH-60H training programs.

Identify Major US or Allied Equipment and Major Threat Equipment

This task is performed in a tactical or classroom environment. The task is described as requiring aircrew to accurately identify major equipment that is expected to be encountered in an area of operations, using photographs, models, or by viewing actual equipment, without reference material.[1] This task can be trained at the squadron level without increased flight time requirements.

Perform Firing Position Operations

This task is performed in the helicopter and entails requiring the aircrew to correctly select a firing position while considering background, range-to-target, altitude in respect to the target, sun and moon positions, shadowing, concealment, rotor-wash,

maneuver area, and field of fire. The task requires aircrew to correctly use aircrew coordination in positioning the helicopter for weapons employment, emphasizing correct terminology for positioning the helicopter.[2] The elements of this task are not foreign to HH-60H aircrews. The terminology of positioning the helicopter is identical to the terminology used by HH-60H aircrews performing a hovering extraction of personnel. The selection criteria are also similar to the criteria HH-60H aircrews used to select insertion zones for NSWS missions. Inclusion of this task in HH-60H training could be incorporated into existing CSAR/NSWS syllabus without increasing the number of syllabus sorties.

Perform Target Handover to Attack Helicopter

This task is to be performed in the helicopter in a tactical or training environment. The task is designed for OH-58D aircrews to pass target and designation information to attack helicopters for remote engagements. The task is designed to standardize the information and format of remote engagement communications.[3] While the HH-60H will not likely be involved in scouting or designating for Army attack helicopters, HH-60H aircrews should have standardized procedures for communicating critical information for remote engagements.

Perform Aerial Observation

This task is performed in the helicopter or orally in a classroom environment. The task requires aircrews to understand procedures for detection, identification, determining the precise location, and reporting enemy contacts. The task also requires aircrews to understand the techniques of aerial observation to include the effects of

altitude, airspeed, terrain, and meteorological conditions on observing threats. Techniques for proper sensor employment, crew coordination, and look out doctrine are discussed.[4]

Call for and Control a Tactical Air Strike

This task is performed in the helicopter in a tactical environment. Aircrews are required to transmit a spot report and a request for a tactical air strike, correctly perform a close air support (CAS) briefing, coordinate laser codes, and provide accurate bomb damage assessment (BDA).[5] Although these procedures are currently taught to HH-60H aircrews during training rotations to the Naval Strike and Air Warfare Center, the task is not currently practically applied.[6]

Perform Techniques of Movement

This task is performed in the helicopter in a tactical situation. Aircrews are required to correctly perform tactical movement using traveling, traveling overwatch, and bounding overwatch techniques. The different techniques are used based on the threat. Traveling is used when enemy contact is not likely. Traveling overwatch is used when enemy contact is possible, and bounding overwatch is used when enemy contact is likely.[7] These techniques are designed to move a large number of helicopters about the battlefield. The HH-60H aircrews currently performing overland CSAR operations are familiar with traveling movement. When considering HH-60H employment in strike operations, traditional Navy techniques of movement may require refinement, particularly when closing the on objective. The HH-60H aircraft are not likely to participate in missions with formations larger than a section of two helicopters.

However, these techniques of movement may be useful on a smaller scale to HH-60H aircrews conducting overland strike operations.

The comparative analysis of HH-60H and OH-58D training tasks has identified a small number of tasks which OH-58D aircrews are trained to perform that HH-60H aircrews are not. Based on this analysis, it can be determined that HH-60H aircrews currently are not properly trained for overland strike operations. However, the training shortfall is very slight. Of the six tasks that were identified as shortfalls, the HH-60H aircrews are currently trained in significant aspects of four of these tasks. Including these tasks in HH-60H aircrew training will require only a slight modification of the existing training program. The two remaining tasks which are currently not trained for, identify major U.S. and allied equipment and major threat equipment and perform target handover procedures, can likewise be easily included in existing training programs without a significant impact.

The training shortfall identified in the comparative analysis between the OH-58D and the HH-60H training programs is a result of the newness of the Hellfire capability from a Navy perspective. Predictably, formalized training will develop rapidly with the new capability. Captain Kircher, Commander, Helicopter Antisubmarine Wing Atlantic stated that, "In many ways training to perform overland strike operations is a natural roll over from CSAR training, and that overland strike operations may not require the level of integration that a CSAR mission requires."[8] Captain Emerson, Commander, Carrier Air Wing Nine, echoed this belief that HH-60H crews are properly trained by stating, "HS has or will train to all the components of the scenario you outlined [referring to the notional scenario contained in chapter 4]. They know how to fly nap-of-the-earth at

night. They know how to insert SEALS. They know how to be covert, and they will soon know how to engage targets with the FLIR Hellfire system."[9]

In addition to individual aircrew training tasks, collective training must be addressed to adequately train aircrews. Hellfire strike exercises would need to be added in all stages of the work up training cycle. These exercises could be separate events or additions to CSAR training exercises. Adequate training facilities exist on both coasts to accomplish this training. Most importantly, collective and integrated Hellfire strike training would need to be implemented during air wing training at the Naval Strike and Air Warfare Center (NSAWC) in Fallon, Nevada. The collective training would be most effective if it was integrated into Air Wing strike training where Hellfire armed HH-60H are part of a strike package. Thus, allowing the Air Wing to exercise command, control, and coordination with Helicopters in the strike package.

Determining if helicopter antisubmarine (light) (HSL) for SH-60B aircrews are properly trained for overland strike operations results in a clearer answer. The SH-60B aircrews are not trained to perform tactical overland flight and do not receive overland NVG training. In a comparison of SH-60B to OH-58D required aircrew tasks, the SH-60B aircrew lack training in the same areas as the HH-60H (table 3). SH-60B aircrews also lack training in a significant number of OH-58D tasks for which HH-60H aircrews are trained (table 4).

Unlike the HH-60H, modifying existing SH-60B aircrew training would require development of an additional training syllabus to include NVG and terrain flight techniques. Incorporating an overland NVG and tactical flight training is not

contemplated in the near future.[10] As a result, it is assessed that SH-60B aircrews are not properly trained for overland strike operations.

Table 4. HH-60H training tasks not included in SH-60B training
Perform confined area operations
Perform slope operations
Perform terrain flight mission planning
Perform terrain flight takeoff
Perform terrain flight
Perform NOE deceleration
Perform quick stops
Perform terrain flight approach
Perform terrain flight navigation
Perform or describe downed aircraft procedures
Perform masking and unmasking
Perform NVG (ANVIS) PM and operational checks
Perform pinnacle or ridgeline operation
Perform high/low G flight
Perform evasive maneuvering
Reconnoiter and recommend an LZ
Negotiate wire obstacles
Perform emergency procedures for NVG failure

The analysis of Seahawk aircrew training programs compared to those of the OH-58D reveals that the programs, at the time of writing this thesis, do not properly train aircrews for overland strike operations. In the case of the HH-60H, the training shortfall is very slight, and training could be modified with minimal impact. It is important to note that HH-60H aircrews are trained to perform a variety of overland tactical missions of which the OH-58D does not perform. Aircrew training tasks, such as performing combat search and rescue and insertion/extraction of Special Forces, were not included in the analysis. Many of the tasks required to perform these missions are similar to the tasks identified as training shortfalls. Incorporating the tasks that are required for overland

strike operations could easily be added to the HH-60H aircrew training program without additional training sorties; these tasks could simply be added to existing sorties with minimal impact. SH-60B training, however, has a significant training shortfall, which would require significant expense of training effort and resources. The prospect of training SH-60B aircrews for overland strike operations seems unlikely.

Tactics

Can existing U.S. Army and Marine Corps tactics for the use of Hellfire armed helicopters be used by or modified for Navy H-60s? This question is best answered in two parts; (1) Can Army and Marine Corps Hellfire engagement techniques be used by Navy H-60s? and (2) Can tactics used by Army attack helicopters for "deep operations" and or Marine Corps tactics for "deep air support" be used by Navy H-60 helicopters in overland strike operations?

A review of Army and Marine Corps techniques for the employment of the Hellfire missile with attack helicopters yields a simple answer to the first part of the question. Army and Marine Corps techniques for the employment of Hellfire are almost identical. The techniques address missile operational modes, launch perimeters, remote lasing techniques, target laser illumination considerations, multiple-missile launch techniques, and weather considerations. The techniques for the employment of Hellfire are exclusively based on the characteristics of the missile system, and not the performance of specific airframes. Thus, Army and Marine Corps tactics and techniques for employing the missile can be used without modification by Navy H-60s in overland operations. It is important to note, however, that techniques for achieving the most effective target designation and missile launch mode selection for the missile in an

overwater environment may be different from overland employment due to differing environmental conditions.[11]

Can tactics used by Army attack helicopters for "deep operations" and or U.S. Marine Corps tactics for "deep air support" be used by Navy H-60 helicopters in overland strike operations? To begin answering the question, it is useful to first define the terms "deep operations" and "deep air support." U.S. Army Field Manual 1-112, *Tactics, Techniques, and Procedures for the Attack Helicopter Battalion*, defines deep operations as, "Those operations directed against enemy forces and functions which are not in contact at the forward line of troops (FLOT)."[12] "Deep air support" is described as offensive air support not requiring detailed integration with friendly ground force's fire and maneuver. Air interdiction and armed reconnaissance are "deep air support" tasks.[13] These types of operations are examined because they closely resemble the types of missions that the H-60 would perform during overland strike operations. To ease discussion, these missions will hereafter be referred to as strike missions.

The basic employment considerations and tactics for these missions are similar for the Army and Marine Corps. The techniques described in the services' tactical manuals are generic and do not require unique aircraft capabilities for their use. In fact, the U.S. Army Field Manual 1-112 describes the tactics and employment considerations for attack missions generically for the AH-64, OH-58D, and the AH-1J. Specific tactics, techniques, and procedures for the employment of attack helicopters are published in individual unit tactical standard operating procedures. The generic nature of these tactics allows their use by properly equipped and trained Navy H-60 units without modification.

The organizational characteristics of Navy H-60 units compared to Army and Marine Corps attack aviation units, however, limit the scope of the tactics applicable for use by the Seahawk. Assuming that SH-60B units are not properly trained and in some cases the aircraft are not properly equipped for overland strike operations, the maximum number of Seahawks available in a single carrier battle group (CVBG) would normally be limited to two to three HH-60H helicopters. This relatively low mass with respect to Army attack aviation units obviously limits the size of tactical formations, but is not so restrictive as to eliminate the use of Army tactics by Seahawk units. In fact, FM 1-112 states, "The basic attack aviation tactical unit is the two aircraft, lead/wingman team."[14] The Marine Corps tactics state that: "The attack flight should be comprised of a minimum of two AH-1W aircraft."[15] Thus, Seahawk units can operate in sufficient mass to use Army and Marine Corps attack helicopter tactics. However, the number of available Seahawk helicopters obviously limits the scope of missions these tactics can be used to perform.

The integration of strike tactics into current HH-60H tactics would not require an enormous or costly effort. A comparison of the contents of the HH-60H Tactical Manual and the AH-1W Tactical Manual reveals that many of the tactics used by AH-1W for overland strike and attack are currently used by HH-60H units for overland CSAR/NSWS missions. The HH-60H tactical manual could be updated for overland strike by simply borrowing applicable Cobra tactics, which are not currently included. The majority of these tactics concern planning and employment considerations, which are not unique to the AH-1W airframe, and thus could be included without formal tactical evaluation for the HH-60H. The inclusion of these AH-1W tactics in the HH-60H tactical manual is a

much easier process than developing new tactics, employment considerations, and techniques from scratch or borrowing tactics from other services. The HH-60H and AH-1W tactical manuals are both developed by Naval Air Systems Command (NAVAIR). Thus using tactics developed under the same command would streamline the process for inclusion of overland strike and attack tactics in the HH-60H tactics manual. The process would only require a simple administrative effort by Air Evaluation Squadron One, the model manager for the HH-60H tactical manual.

Navy H-60 aircraft can use Army and Marine Corps tactics for Hellfire employment. Operational decisions concerning the use of these tactics for certain missions, however, are limitations due to the relatively small number of Navy HH-60H aircraft which can be expected to be available for any given mission.

While not directly related to the issue of adopting Army and Marine Corps tactics for use by Navy H-60 units, a brief discussion of how NSWS tactics might be leveraged for overland strike operations is useful in the discussion of future tactical employment. The use of self-deployed Special Forces in conjunction with Hellfire-armed HH-60H aircraft might enhance the survivability and covertness of an overland strike mission. An example of such employment might be to insert Special Forces with a laser designator on the slope of a terrain feature between the helicopter and the target. The Special Forces could then lase the target allowing the helicopter to launch the missiles without unmasking. The Special Forces then could be embarked prior to egress.

Risk-to-Benefit Analysis

Is the use of the Seahawk, armed with Hellfire, in overland strike operations prudent given the other strike assets available in the carrier battle group (CVBG)? The

views of Navy leadership are used to answer this final research question. As might be expected, there is a wide variance in the opinions of the leaders interviewed. There are, however, some issues that have universal agreement. There are also some common themes that can be used to generalize the current views of naval leadership.

The leaders interviewed included Carrier Group (CARGRU), Carrier Air Wing (CVW), Destroyer Squadron (DESRON), Helicopter Antisubmarine Wing, Helicopter Antisubmarine (light) Wing, and squadron commanders. The leaders unanimously agreed on a few central points. Using the SH-60B in overland strike operations is not prudent, and the SH-60B does not have a role in overland strike. They also agreed that it is prudent to use Hellfire armed HH-60H aircraft to attack overland targets as a defensive measure in CSAR and NSWS missions.

The leaders explained the inadvisability of using SH-60B helicopters in overland strike operations for three primary reasons: the SH-60B aircrews are not trained for an overland mission, the SH-60B is an indispensable part of the surface-combatant's ability to perform its mission, and the SH-60B is currently tasked to the limits of its ability in the performance of sea control missions (ASUW and USW).

The leaders interviewed, also, unanimously agreed that the HH-60H, armed with Hellfire, has a role in overland attack. The role, in which the leaders agree is prudent, is the use of the Hellfire missile to attack ground targets as part of a CSAR or NSWS mission. The role is considered defensive in nature in order to enhance force protection. Captain Emmerson, Commander CVW-9, described his view of the overland use of Hellfire by HH-60H aircraft, as a defensive measure to accomplish a CSAR mission. A scenario he used to describe this role was to use Hellfire to take out a convoy of trucks

competing with the CSAR helicopter to reach the survivor.[16] This defensive role, however, is not the role of which this thesis focuses.

The central issue of whether leaders consider it prudent to use HH-60H aircraft in offensive overland strike operations is the point at which opinions diverge. The opinions varied from HH-60H aircraft should be fully integrated into the CVW suppression of enemy air defense (SEAD) plans[17] to the opinion that HH-60H aircraft have no role because fixed-wing aircraft can do it all with less risk.[18]

The leaders in favor of an offensive overland role for the HH-60H identified several key factors and capabilities that can be used to increase the force-projection capability of the carrier battle group. With good intelligence on the locations of enemy forces, an ingress route can be developed that allows a HH-60H aircraft, armed with Hellfire, to covertly ingress to a target area and engage a target before being detected by the enemy. The ability to operate covertly is believed to greatly enhance aircraft survivability and the achievement of tactical surprise.[19] Additionally, the Hellfire missile system allows HH-60H aircraft to precisely engage and destroy an enemy target with little risk of collateral damage. In some cases the Hellfire is a more-effective and cost-efficient weapon than fixed wing munitions. Captain Kircher stated that the Hellfire "is a cheap missile, and it has a higher probability of hit than the MK 82 bomb series, and certainly the HARM missile."[20]

The leaders endorsing the use of the HH-60H in offensive overland strike operations perceived the major issue or challenge which must be resolved before the helicopter could be used in such a role, is overcoming the philosophical mind-set of the tactical aircraft (TACAIR) leaders. The mind-set is perceived to be that TACAIR

leadership embraces a cultural bias that fixed-wing aircraft have supremacy in all things relating to delivering ordnance.[21] Captain Golden referring to the establishment of an overland strike role for the HH-60H stated, "Our biggest challenge is convincing our fixed wing brothers."[22] Captain Fuqua, Commander Helicopter Antisubmarine Wing Pacific, when asked why is it that battle group commanders were willing to use OH-58D helicopters armed with Hellfire in overland strike during the Gulf War, but some current leaders do not see a similar role for the HH-60H, responded:

> It's a mindset, that is the only thing it can be. You can't look objectively at the aircraft [HH-60H] and say it could not perform that mission. And you could not look objectively at the amount of training our guys do, and that they are capable of absorbing and say that the aircraft couldn't perform the mission. So it just comes down to some weird bias.[23]

Proponents for using HH-60Hs in overland strike also agreed that the nature of the enemy threat would factor heavily in the decision to use the helicopter. Missions requiring the helicopter to fly near troop concentrations with man-portable, air defense missiles were considered a no-go criteria for the helicopter. Basically, as the threat levels increase, the HH-60H's role decreases.

Navy leaders, who view the HH-60H as not having a role in offensive overland strike, offer common reasons for their views. With only three HH-60H aircraft in the battle group, the helicopters would be needed for other missions, such as CSAR, ASUW, and NSWS.[24] The number of helicopters available to perform overland strike operations certainly creates an issue of resource allocation. However, returning to the basic assumptions of the thesis, any overland strike role is assumed to be a limited role. An argument can be made that in some situations the ASUW mission of the HH-60H could be adequately filled by other battle group assets, particularly the SH-60B which has a less

plausible role for overland strike. It is also interesting to note that the HH-60H did not have offensive ASUW capability until the introduction of FLIR and Hellfire, and that carrier battle groups were able to conduct strike operations and ASUW concurrently without the assistance of the HH-60H. An argument can also be made that assigning HH-60H aircraft an overland strike mission would not eliminate the battle group's ability to conduct CSAR. The HH-60H strike aircraft could be hot-seated to CSAR alert crews after completing a strike mission. In a permissive environment, strike HH-60H aircraft could be used to rescue survivors during egress. In any case, using HH-60H aircraft in overland strike operations does not eliminate CSAR capability.

Another reason given to support the view that H-60s do not have a role in overland strike was that training for overland strike may overtask HH-60H units given the number and types of missions the HH-60H must currently train to perform. Rear Admiral Bryant stated, "It is a matter of aircrew training as much as anything, time, effort and dedication of already squeezed assets, meaning helo flight crews. Getting them beefed up in yet another almost completely different mission would require a lot of money and training."[25] Admiral Bryant's concerns of an overly cumbersome training requirement certainly have a direct application to a decision to train SH-60B aircrews for an overland strike mission. However, the training carryover from the HH-60H aircrews training program for overland CSAR and NSWS missions greatly diminishes the training requirement for HS aircrews. As discussed earlier in this chapter, the cost and effort to train HH-60H aircrews for overland strike are not as extensive as they might appear at first glance.

Officers who viewed the HH-60H as not being a player in offensive overland strike also believed, when the enemy threat is such to allow an HH-60H to perform an overland strike mission, there is still no reason not to use fixed wing for the same target. Although leaders on both sides of the issue would agree that tactical aircraft can destroy any target that an HH-60H could destroy with Hellfire. Examining the issue in more detail may yield a more meaningful answer. The HH-60H can be a force multiplier. There are only fifty bomb droppers on an aircraft carrier and not all of them could be launched on a single strike due to flight deck restrictions. In some situations, HH-60H aircraft could provide strike capability that is different than current carrier TACAIR capabilities. As mentioned earlier, HH-60H aircraft can operate covertly, Hellfire may be a more cost-effective weapon, and in some cases Hellfire might be a more appropriate weapon to precisely destroy a target when collateral damage is a prime concern. Applications requiring these unique capabilities may be few and far between, but dismissing the validity of an overland strike role for the HH-60H on the basis that fixed-wing aircraft can do it all may fail to use the system to its fullest capability.

Determining why Navy leaders have such divergent views on the central question of should HH-60H aircraft armed with Hellfire have a role in offensive overland strike operations unfortunately requires some degree of speculation. The most likely cause for the variance in views is the immaturity of the FLIR/Hellfire from a Navy perspective. At the time of writing this thesis, the process of upgrading all the helicopters is not complete and FLIR/Hellfire training is just beginning. Captain Emerson stated, "Doctrine-wise, nobody has thought through how we are going to do this. That is typical of a lot of new things that get introduced, we think we are going to use them one way, and we end up

using them for something else."[26] The capabilities of Navy H-60s armed with Hellfire are an unknown quantity to many leaders. There is no doctrine developed for offensive overland use of the system. As a result, many leaders do not have the confidence to sign up for using HH-60H aircraft in overland strike. "The jury is still out, I would say that most people are reluctant to use the HH-60H overland in an offensive role at this point. Now, five years down the line maybe we will have a lot more confidence. . . . In the back of my mind I know my HS guys could do it."[27]

A consensus could not be reached on all aspects of the final subordinate research question. The research showed clearly that Navy leadership does not consider it prudent to use the SH-60B in overland strike operations. Conversely, Navy leaders feel that using Hellfire with the HH-60H does have at least a limited role in overland strike as a defensive weapon. The jury is still out on the use of HH-60H in overland offensive strike operations. In many ways the reluctance shown by some leaders is likely due to the immaturity of the system. As confidence builds and philosophical and doctrinal issues are examined more closely, many more leaders may swing to the proponent column.

The analysis of aircraft capabilities, aircrew training, potential tactics development, and the views of naval leadership have provided a sound background for the conclusions contained in chapter 6. The analysis has also provided insight into the key issues confronting the Navy in determining what role if any H-60 helicopters armed with Hellfire have in overland strike operations. As the analysis has shown, there is an ambiguous element in the information presented. While not all will agree with the analysis, hopefully the information presented will stimulate deeper thought on the issue.

[1]U.S. Army, Training Circular 1-209, *Aircrew Training Manual Observation Helicopter, OH-58D Aviator/Aeroscout Observer* (Washington, DC: Department of the Army, December 1992), 6-107.

[2]Ibid., 6-118-119.

[3]Ibid., 6-161.

[4]Ibid., 6-79-83.

[5]Ibid., 6-167.

[6]Lieutenant Roy Undersander, telephonic interview by author, Ft. Leavenworth, KS, 15 January 1999.

[7]U.S. Army, Training Circular 1-209, 6-172.

[8]Captain Kirtcher, USN, Commander Helicopter Antisubmarine Wing Atlantic, interview by author, 3 March 1999, Ft. Leavenworth, KS, tape recording.

[9]Captain M. Emerson, USN, Commander Carrier Air Wing Nine, interview by author, 19 March 1999, Ft. Leavenworth, KS, tape recording.

[10]Captain Richard Mayne, Commander Helicopter Antisubmarine (Light) Wing Pacific, interview by author, 1 March 1999, Ft. Leavenworth, KS.

[11]Robert Blevens, interview by author, 5 March 1999, Ft. Leavenworth, KS.

[12]U.S. Army, Field Manual 1-112, *Attack Helicopter Operations* (Washington, DC: Department of the Army, April 1997), H-1

[13]U.S. Navy, Naval Warfare Publication 3-22.5, *AH-1W Tactical Manual,* vol. 1 (Washington, DC: Navy tactical support activity), 11.1.4 [CD ROM] NTIC series B1 release December 1997.

[14]U.S. Army, Field Manual 1-112, 3-31.

[15]U.S. Navy, Naval Warfare Publication 3-22.5, *Ah-1W,*10.4.1

[16]Emerson.

[17]Kirtcher.

[18]Rear Admiral Stanley Bryant, telephone interview by author, 8 March 1999, Ft. Leavenworth, KS, tape recording.

[19]Captain Kenneth Golden, USN, interview by author, 19 January 1999, Ft. Leavenworth KS.

[20]Kirtcher.

[21]Thomas Cirillo, "Learning from the Army," *Naval Institute Proceedings* 118, no. 9 (September 1992): 100.

[22]Golden.

[23]Captain M. Fuqua, Commander, Helicopter Antisubmarine Wing Pacific, telephone interview by author, Ft. Leavenworth, KS, 22 March 1999.

[24]Emerson

[25]Bryant.

[26]Emerson.

[27]Ibid.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

The research and analysis presented has shown that the answer to the primary research question, Do Navy H-60 helicopters, armed with an AGM-114 Hellfire missile system, have a role in littoral overland strike operations? cannot be answered with an emphatic yes or no answer. There are different answers depending on the series of H-60 in question and the nature of the envisioned overland role. This chapter will answer the question in four parts: (1) Does the SH-60F have a role in overland strike operations? (2) Does the SH-60B armed with Hellfire have a role in overland strike operations? (3) Does the HH-60H armed with Hellfire have a role in overland strike operations? and (4) Does the HH-60H have a role in offensive strike operations using Hellfire? The significance of this study to the philosophical employment of Navy helicopters will be examined, and recommendations will be made for areas of further study.

The SH-60F's Role

This helicopter has not yet been upgraded for FLIR/Hellfire. If and when the aircraft is upgraded for FLIR/Hellfire, the aircraft would still lack the aircraft survivability equipment (ASE) necessary for overland operations in a hostile environment. Therefore, it is assessed that the SH-60F does not have a role in overland strike operations without significant ASE improvements.

The SH-60B's Role

Currently the SH-60B is not properly equipped for the mission due to an inadequate nigh-vision capability. With the addition of NVGs, aircraft modified to

include aircraft survivability equipment could be considered adequately equipped for the mission. The lack of overland tactical training by SH-60B aircrews, however, eliminates consideration for any current overland strike applications. The future use of the aircraft in overland strike applications is unlikely. There are no plans to institute an overland training program. Training aircrews for overland tactical missions would require a significant investment in time and resources. Such investment is considered unlikely and unwise considering the nature of the aircraft's current missions. Surface combatants rely heavily on the SH-60B as an airborne sensor platform. Surface ships would lose significant capability to perform their missions if the SH-60B were tasked with overland missions. Consequently, the SH-60B does not have a role in overland strike operations.

The HH-60H's Role

The HH-60H is adequately equipped for overland strike operations. It fact, the HH-60H is a more capable platform for night time missions than the OH-58D which is combat proven in overland strike operations. The HH-60H aircrews currently are trained to perform most aspects of the mission. Only a slight adjustment to existing training programs will be necessary to incorporate the training tasks and skills necessary for HH-60H aircrews to be successful in overland strike operations. Similarly, combat proven overland strike tactics used by Hellfire armed Army and Marine Corps helicopters can be used by HH-60H without extensive tactical development and evaluation. The HH-60H aircrews are, or soon will be, sufficiently trained for a role in overland strike. The aircraft is more than sufficiently equipped for the mission. The only issue which requires resolution before a role in overland strike operations can be established is gaining support of Naval leaders who would be responsible for tasking the HH-60Hs with such a mission.

The Naval leaders interviewed agree that the HH-60H armed with Hellfire has a limited role in overland strike operations. The agreed upon role is the use of Hellfire to engage overland targets as a means of defensive fire support for CSAR and NSWS missions. Thus, Hellfire-armed HH-60H helicopters have a role in littoral overland strike operations.

This defensive use of Hellfire in CSAR and NSWS missions, however, does not expand the mission areas of HH-60H aircraft. The discussion of expanding the HH-60H's mission base in overland strike to include offensive use of the Hellfire missile is where the views of leaders diverge. The issues surrounding the perceived unsuitability of the HH-60H in an offensive role were examined in some detail in chapter 5. Arguably, leaders who feel that the use of the Hellfire with the HH-60H should be exclusively defensive, base their opinions on a mind-set of traditional philosophical use of Navy rotary-wing aircraft and on a lack of confidence in the in the HH-60H/Hellfire weapon system. The lack of confidence stems primarily from the immaturity of the system from a Navy standpoint. Thus, determining what role, if any, the HH-60H has in offensive overland strike operations is largely dependent on the particular views of the leader with tasking authority. In the near term, the HH-60H in most cases will not have a role in offensive strike operations. However, as the system becomes more mature and leadership gains confidence in the system, the answer will likely be that the HH-60H armed with Hellfire will have a limited role in overland offensive strike operations.

Significance of the Study

The study has shown that for various reasons the SH-60B does not have a current or likely future role in overland strike operations. Tactics development for the SH-60B

use of the Hellfire system should be directed at overwater applications of the missile system. The study has also shown that overland applications of the SH-60B would be unwise and should be avoided unless aircrews receive extensive overland tactical training and all aircraft are equipped with aircraft survivability equipment and night-vision capability.

Conversely, the study has shown that the HH-60H aircraft is in some ways out performs other helicopters that are capable of the overland strike mission. The limiting factor for future use of the Hellfire system with HH-60H aircraft in offensive strike operations is not the capability of the airframe or the aircrew, but rather the will of Navy leadership to employ the helicopters in the role. The HH-60H can be an effective force multiplier in offensive strike operations. Hopefully this study can serve as a catalyst for change of the traditional mind-set that Navy helicopters, particularly the HH-60H, are not fit for an offensive strike role. Navy leaders that objectively evaluate the capabilities of the HH-60H aircraft and the aircrews flying them will realize that they are or soon will be as capable as other helicopters that perform the mission.

As described in chapter 3, OH-58D aircraft embarked on Navy ships have been tasked by Navy commanders to conduct offensive overland strike operations. Hopefully this study might stimulate enough thought to compel leaders to ask themselves: Why is it that the OH-58D is considered capable to perform offensive overland strike operations, but HH-60H is not considered as capable? As confidence in the capability grows, the reluctance of the leadership should decrease.

The study has provided a foundation for an expansion of the Navy's philosophical use of the HH-60H helicopter. As Captain Emerson stated, "Doctrine-wise, nobody has

thought through how we are going to do this."[1] The study has validated the capability for nontraditional applications of HH-60H helicopters. Hopefully, the study will stimulate doctrine evaluation, to include a limited role in offensive strike operations.

Suggestions for Further Study

This study has concluded that the SH-60F helicopter, once upgraded for FLIR/Hellfire, will still lack aircraft survivability equipment (ASE) necessary for overland applications. Given that the same aircrews fly the SH-60F and HH-60H, aircrew training for overland strike operations for the SH-60F would not be an issue. Therefore, it can be assumed that if the SH-60F helicopters were upgraded with a similar ASE package to that of the HH-60H that it would have an equally viable overland strike role. Upgrading SH-60F aircraft to include FLIR/Hellfire and ASE would eliminate many of the resource allocation considerations for using the helicopters for overland strike. A study examining the feasibility and cost and operational benefits of upgrading the SH-60F is recommended.

This study has also concluded that the use of Hellfire has accepted defensive application in CSAR and NSWS missions. CSAR and NSWS tactics currently stress threat avoidance, versus threat engagement. The Hellfire system while admittedly lethal, requires active laser designation until missile impact. The missile's time of flight at maximum ranges may require the helicopter to designate the target in excess of thirty seconds. As a result, Hellfire might not be the most effective weapon to suppress enemy fire in a defensive role. A study to determine the Hellfire's effectiveness in this role and

a study into the Hellfire's effectiveness in a defensive role compared to other weapons, such as 70-millimeter rockets, are recommended.

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[1]Captain M. Emerson, Commander, CVW-9, telephone interview by author, Ft. Leavenworth, KS, 19 March 1999, tape recording.

APPENDIX

COMPARISON OF TASKS

AIRCREW TASKS	AH-64	AH-1W	OH-58D	HH-60H	SH-60B
Conduct crew mission briefing	X	X	X	X	X
Plan a VFR flight	X	X	X	X	X
Plan an IFR flight	X	X		X	X
Prepare weight and balance clearance	X	X	X	X	X
Perform preflight inspection	X	X	X	X	X
Perform engine start, runup, hover, & before-takeoff	X	X	X	X	X
Perform straight and level flight		X	X	X	X
Perform turn, climbs, and descents		X	X	X	X
Perform NVS operational checks	x	X	X	X	X
Perform ground taxi	X	X		X	X
Perform hover power check	X	X	X	X	X
Perform hovering flight	X	X	X	X	X
Perform a normal takeoff	X	X	X	X	X
Perform quick stops	X	X	X	X	X
Perform a rolling takeoff	X			X	X
Perform simulated maximum performance takeoff	X	X		X	X
Perform deceleration/acceleration	X	X		X	X
Perform traffic pattern flight	X	X	X	X	X
Perform fuel management procedures	X	X	X	X	X
Navigate by pilotage and dead reckoning	X	X	X	X	X
Operate navigation system		X	X	X	X
Operate communication system		X	X	X	X
Perform doppler navigation	X	X		X	X
Perform before-landing check	X	X	X	X	X
Perform VMC approach	X	X	X	X	X
Perform roll-on/running landing	X	X	X	X	X
Perform no-hover (max gross weight) landing		X		X	X
**Perform confined area operations	X	X	X	X	
**Perform slope operations	X	X	X	X	
**Perform terrain flight mission planning	X	X	X	X	
**Perform terrain flight takeoff	X	X	X	X	
**Perform terrain flight	X	X	X	X	
Perform hover OGE check		X	X	X	X
**Perform NOE deceleration	X	X	X	X	
**Perform terrain flight approach	X	X	X	X	
Perform emergency AHRS approach			X	X	X
Perform high speed flight	X	X		X	X
Perform standard autorotation	X	X	X	X	X
Perform simulated engine failure, IGE hover	X	X	X	X	X
Perform simulated engine failure, at altitude	X	X	X	X	X
Perform simulated engine failure, OGE hover	X		X	X	X
Perform single engine landing	X	X		X	X
*Perform analog throttle operation			X		

Perform ECU lockout operations	X	X		X	X
Perform procedures for stabilator malfunction	X			X	X
Perform simulated stability system malfunction		X	X	X	X
**Perform terrain flight navigation	X		X	X	
Perform or describe emergency procedures	X	X	X	X	X
Perform standard instrument departures		X		X	X
Perform BI (S-1, turn patterns, Oscar patterns)		X		X	X
Perform instrument takeoff	X	X	X	X	X
Perform radio navigation	X	X		X	X
Perform instrument autorotation		X		X	X
*Perform VAPI approach			X		
Perform holding procedures	X	X		X	X
Perform unusual attitude recovery	X	X	X	X	X
Perform radio communication procedures	X	X	X	X	X
Perform procedures for two-way radio failure	X	X	X	X	X
Perform nonprecision approach	X	X	X	X	X
Perform precision approach		X	X	X	X
Perform or describe inadvertent IMC procedures	X	X	X	X	X
**Perform or describe downed aircraft procedures		X	X	X	
**Perform masking and unmasking	X	X	X	X	
Identify US or allied equipment and threat equipment	X		X		
Operate aircraft survivability equipment	X	X	X	X	X
Perform after landing tasks	X	X	X	X	X
Operate IFF system	X	X	X	X	X
**Perform NVG (ANVIS) PM and operational checks		X	X	X	
*Perform MMS operations			X		
Perform THCDP operations		X			
Perform NTS operations		X			
Perform TADS operational checks	X				
Perform TADS boresighting	X				
Perform TADS sensor operations	X				
Perform IHADSS boresighting	X				
Perform IHADSS video adjustments	X				
Perform IHADSS operations	X				
Perform FM homing			X	X	X
Operate data transfer system			X	X	X
Perform data entry procedures	X			X	X
Perform aircraft position update function procedures	X			X	X
Perform target store procedures	X	X		X	X
Perform firing position operations	X	X	X		
Engage target with Hellfire	X	X	X	X	X
*Engage target with rockets	X	X	X		
*Engage target with Sidearm		X			
*Engage target with Sidewinder		X			
*Engage target with gun turret	X	X			
*Engage target with TOW		X			
*Operate air-to-air Stinger system			X		
*Operate .50 caliber machine gun			X		

Perform weapon initialization procedures	X	X	X	X	X
Perform target handover procedures	X	X	X		
Perform target tracking	X	X		X	X
**Perform pinnacle or ridgeline operation	X		X	X	
**Perform high/low G flight	X			X	
Perform aerial observation	X	X	X		
Perform aerial combat maneuvering (ACM)		X			
**Perform evasive maneuvers	X	X	X	X	
Perform multi aircraft operations	X	X	X	X	X
**Reconnoiter and recommend an LZ or a PZ	X	X	X	X	
Perform Helicopter escort		X			
Perform Forward Air Controller operations		X			
Perform a route reconnaissance	X		X		
Call for and adjust indirect fire	X		X		
Transmit information using visual signaling techniques	X		X	X	
Perform laser spot tracker operations	X	X			
Perform FARP procedures	X	X	X	X	
Perform actions on contact	X	X	X	X	
Search for and identify targets	X	X			
Select appropriate weapon system	X	X	X		
Perform target tracking with TADS	X				
Perform target tracking with NTS		X			
Perform target tracking with FLIR				X	X
Operate on-board recording system	X		X	X	X
Reconnoiter and recommend a holding area	X		X		
Perform a security mission	X		X		
Call for and control a tactical air strike	X	X	X		
Perform a zone reconnaissance	X		X		
Perform an area reconnaissance	X		X		
Perform diving flight	X	X		X	X
**Perform emergency procedures for NVG failure	X	X	X	X	
Perform techniques of movement	X	X	X		
**Negotiate wire obstacles	X	X	X	X	
Perform tactical communication and ECM procedures		X	X	X	X
*Perform tactical comm. and ECCM procedures	X	X			
Transmit a tactical report	X	X	X	X	X
Conduct a fire-for-effect mission using MMS&ATHS			X		
Conduct a suppression mission using MMS&ATHS			X		
Conduct a immediate supression mission			X		
Call for and designate for Copperhead LGM			X		
***Perform Combat Search and Rescue (CSAR)				X	
***Perform SW forces insertion/extraction				X	

Legend:

* OH-58D Tasks not performed by HH-60H and SH-60B considered to be aircraft/weapons specific.

OH-58D Tasks not performed by HH-60H and SH-60B considered to be mission related.

**OH-58D Tasks performed by HH-60H, but not by SH-60B.

***Tasks performed by only the HH-60H

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